

FLOATING AIR BASES AND FLYING BOATS: AN HISTORICAL AND
ARCHAEOLOGICAL STUDY OF THE TWO SEADROMES ESTABLISHED AT SAIPAN

by

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ABSTRACT

The use of seaplanes and seaplane bases in a military capacity numerically peaked during the Second World War in the Pacific Theater where they were ideally suited for that arena of vast ocean dotted with specks of land. In their drive across the region, the United States Navy constructed numerous seaplane bases in newly captured territory. These bases connected the forward area with the rear for transport, reconnaissance, anti-shipping/anti-submarine, and air-sea rescue roles. At Saipan in mid-1944 two such seaplane bases were established.

The first was entirely water-based and broke the norm up to that point in the war in terms of the timeline as it was formed while the Allied operation to capture the island had just begun and the region was still hotly contested. Known as a “forward-area seadrome,” new procedural methods were developed there through trial and error and battlefield modification that became a standard operation that was incorporated into strategic plans through the remainder of the Pacific War. The second seaplane base was constructed inside the island’s sheltered body of water, Tanapag Lagoon, and ashore at Flores Point out of the necessity to both disband the floating facility and to have more efficient and permanent seaplane operations on the island.

Establishment of this second facility involved extensive survey, salvage, and construction efforts all while still conducting seaplane operations.

Historically, this thesis will document the establishment of seaplane facilities at Saipan; specifically, how and why they were created, and the technological and procedural developments and events that lead to the unique seaplane situation at Saipan. Archaeologically, field surveys conducted for this thesis in July of 2019 aimed to document cultural material related to these facilities in both terrestrial and underwater environments. Furthermore, knowledge of the standard salvage and operational procedures used at these seaplane facilities obtained through archival research was used to examine the wreck of a Martin PBM Mariner flying boat (a wreck known to have been attached to the Tanapag facility) in an attempt to specifically identify the wreck through site formation processes.

Key Words: seaplanes, seaplane bases, Second World War, Pacific Theater, United States Navy, Saipan, forward-area seadrome, Tanapag Lagoon, Flores Point, salvage, construction, archaeology, Martin PBM Mariner

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By

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Dedication

This work is dedicated to both of my grandfathers. The first, Raymond T. Adamson, I never knew as he passed when my own father was but three years old. I got to know him through items of his stowed away in old footlockers throughout our attic. Prior to serving in the skies over Europe in the last year of the Second World War, he was a supervisor at the Glen L. Martin Middle River Manufacturing Facility where the Martin PBM Mariner was manufactured and left around the time the Tanapag Lagoon wreck was constructed. Therefore, I feel a personal connection with him when working with that particular wreck and feel it only fitting that he be included in this dedication.

My other grandfather, Bennie L. Grove, served in the U.S. Navy during the Korean War and flew back and forth across the Pacific often landing on the small islands that were battlefields only ten years prior. The stories he told and photographs he showed me fueled a passion inside of me for that specific theater. My grandfather and I enjoyed going to any United States Civil War battlefield we could find, especially near his home in Fredericksburg, Va, and spent hours walking around and learning. Even if we had done it 100 times, he always loved to take me. He played an enormous role in my passion for military history and if he were alive today would be thrilled about this project. He is missed.

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This thesis began when I inquired to Dr. Jennifer McKinnon about the PBM Mariner wreck she had been working on in Saipan. After initial research into the aircraft, Dr. McKinnon had the wherewithal to recognize that the seadrome topic made for a much more interesting thesis and from that day forward she has guided, advised, and assisted to her utmost capacity throughout. This project would not have been possible without her personal touch and professionalism.

Thank you to the members of my committee, Dr. Todd Bennett and Dr. Jason Raupp. Your feedback and critiques have made this a polished work of which I am very proud of. Scott Eck in particular deserves special recognition. When my arrangements for a dive boat in Saipan fell through, Scott graciously offered his boat and time out of his day to get me to and from sites inside Tanapag Lagoon. The underwater work for this project would not have occurred otherwise. He is a fantastic boat captain and all-around great guy.

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Finally, I would like to thank my wife, Rachel. When we were only dating, she could tell that my profession at the time was not rewarding to me and was taking a toll on my happiness. After poking and prodding, I finally admitted to her a dream that had been with me since boyhood: to be an underwater archaeologist. Thereafter she pressed me to pursue that dream and

was unwavering in her love, encouragement, and support from the application process through today. This aspiration simply would not have been realized without her. Thank you for making this fantasy become a reality.

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Abbreviations

AAR	Aircraft Accident Report
BuNo	Bureau Number
CinCPac	Commander in Chief Pacific Fleet (Admiral Nimitz)
CNMI	Commonwealth of the Northern Marianas Islands
CTF	Commander Task Force
CTG	Commander Task Group
D-Day	Dog Day
FAW	Fleet Air Wing
H.O.	Hydrographic Office
IFF	Identify Friend of Foe
JATO	Jet Assisted Take Off
NAB	Naval Air Base
NARA	National Archives and Records Administration
PATSU	Patrol Service Unit
PatWing	Patrol Wing
RG	Record Group
RNAS	Royal Naval Air Service
TBS	Talk-Between-Ships
TG	Task Group
VH	Rescue Squadron
VP	Patrol Squadron
VPB	Patrol Bombing Squadron
U.S.	United States
USN	United States Navy
USS	United States Ship

Chapter 1 Introduction

Saipan, a small island in what is today the Commonwealth of the Northern Marianas Islands (CNMI), was the site of one of the fiercest, most pivotal battles of the Second World War. The struggle for control of the island directly led to the Battle of the Philippine Sea and it was later from Saipan that a strategic bombing campaign against the Japanese homeland was conducted. Saipan's prominence in the Pacific War has made it a well-studied battle. Some operational components of the battle have yet to be considered including a semi-mobile seaplane base, or "seadrome," that was established in the rough seas offshore of the invasion beaches in haste under enemy fire on only the second day of the battle for the island. The seadrome, called "Garapan Roads," was created out of situational necessity rather than by planned design, and was the culmination of technological advancement and procedural development up to that point. In only a few months, numerous innovations and battlefield modifications occurred at Garapan Roads and the end product was adopted into the strategic plans for most major amphibious operations through the remainder of the war.

Following the capture of the island but before the United States' next strategic thrust into the Palaus, a major salvage and construction operation was conducted in and around Saipan's Tanapag Lagoon for the purpose of opening the island's harbor and establishing a permanent seaplane base and seadrome. The Tanapag Seadrome and Flores Point Seaplane Base that arose from these efforts were collectively commissioned as United States Naval Air Base 3245: Saipan, Marianas Islands (NAB Saipan) on 1 October 1944. The birth of both seaplane facilities and the disbanding of one are inextricably intertwined.

1.1. Brief Overview of Saipan

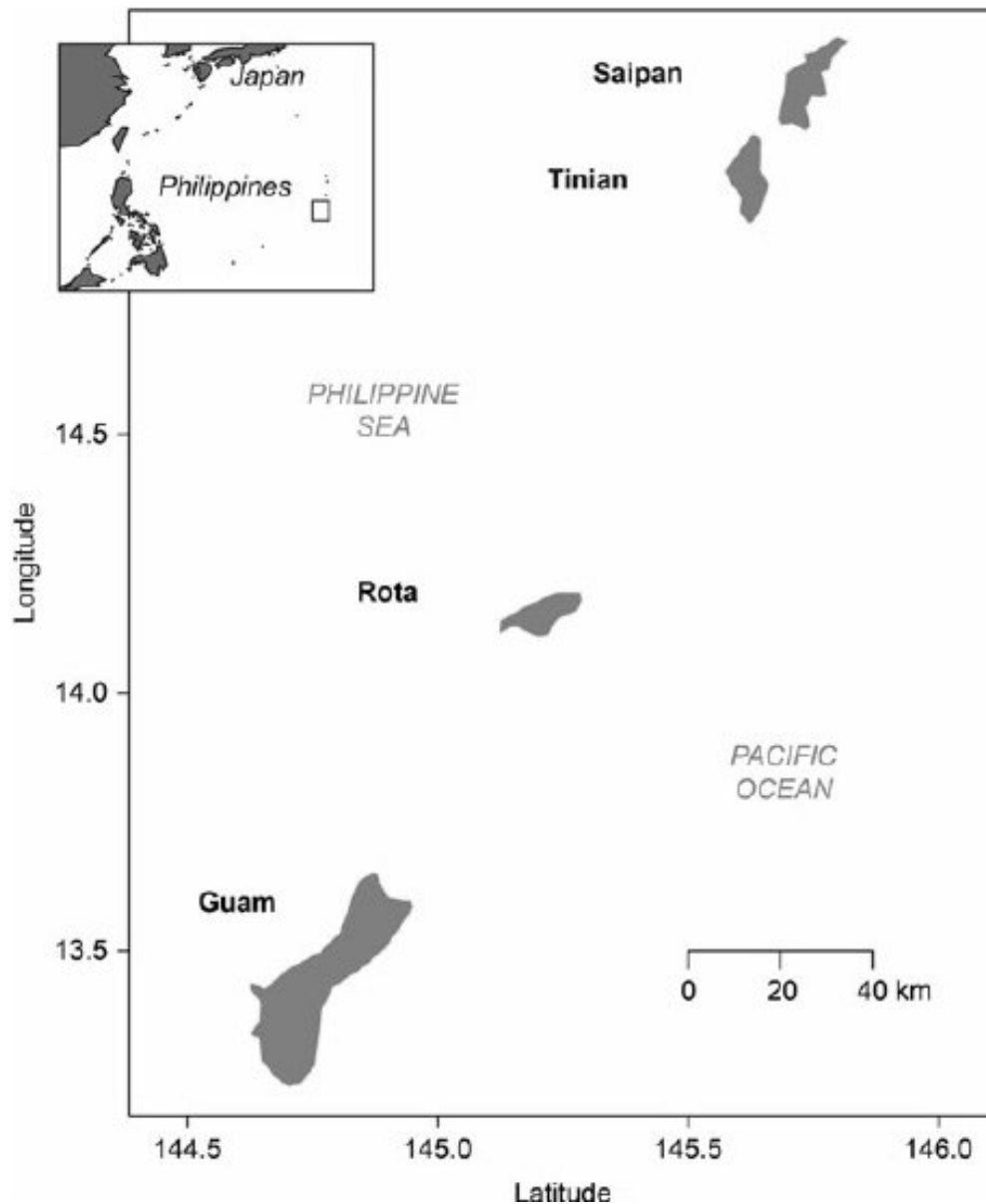


FIGURE 1.1. Location of Saipan and the Marianas Islands (Image courtesy of https://www.researchgate.net/publication/284171700_Vertebrate_seed_dispersers_maintain_the_composition_of_tropical_forest_seedbanks/figures?lo=1).

Saipan is located approximately 125 miles Northeast of Guam and is the second largest island in the Mariana Islands, collectively known as the CNMI. It is approximately 12 miles in length with a width of approximately 5.5 miles. There are flat lowlands on the south and west of the island relatively devoid of natural obstacles while the central portion of the island is rocky

and mountainous. By the time Magellan arrived in 1521, the Indigenous peoples of Saipan, known as “Chamorro” after their language, had inhabited the island for thousands of years. The explorer claimed Saipan and the rest of the Mariana Islands for Spain and they remained under Spanish rule until 1899 when the entire territory was sold to Imperial Germany (with the exception of Guam which was captured by the United States (U.S.) a year prior in the Spanish-American War) (Hoffman 1950). Imperial Germany was in control shortly after the outbreak of World War One (WWI) when Japan, as a member of the allied powers, became the overseers of the island with their ownership and authority over Saipan and the rest of the Mariana Islands being officially recognized in 1920 (again, with the exception of Guam which was still a territory of the U.S.) (FIGURE 1.1).

Japan began to develop fisheries and build up sugarcane operations on the island. Saipan’s infrastructure was built up with a railroad line running the circumference of the island to transport the sugar cane and the island’s main city, Garapan, became a small metropolis with a large influx of Japanese citizens. With the outbreak of the World War Two (WWII), Saipan and the Marianas took on a whole new significance. Japanese forces in the area invaded Guam on the same day as the attack on Pearl Harbor, completing its capture on 10 December 1941. The Marianas, along with the Marshalls, Gilberts, and several other island chains, became key points for Japan’s sphere of influence in the Pacific as well as crucial to their defenses against allied encroachment. As the war turned against the Japanese in late 1942 and their situation deteriorated steadily through 1943 and into 1944, it became obvious that the control of the Marianas, and especially Saipan, would be crucial to the outcome of the war. To this end, the Japanese ramped up defenses on Saipan by building airfields, artillery emplacements, and trench

systems. Saipan soon became the most fortified position in the island group with a garrison of approximately 32,000 officers and soldiers, including a regiment of 48 tanks (Gailey 1995).

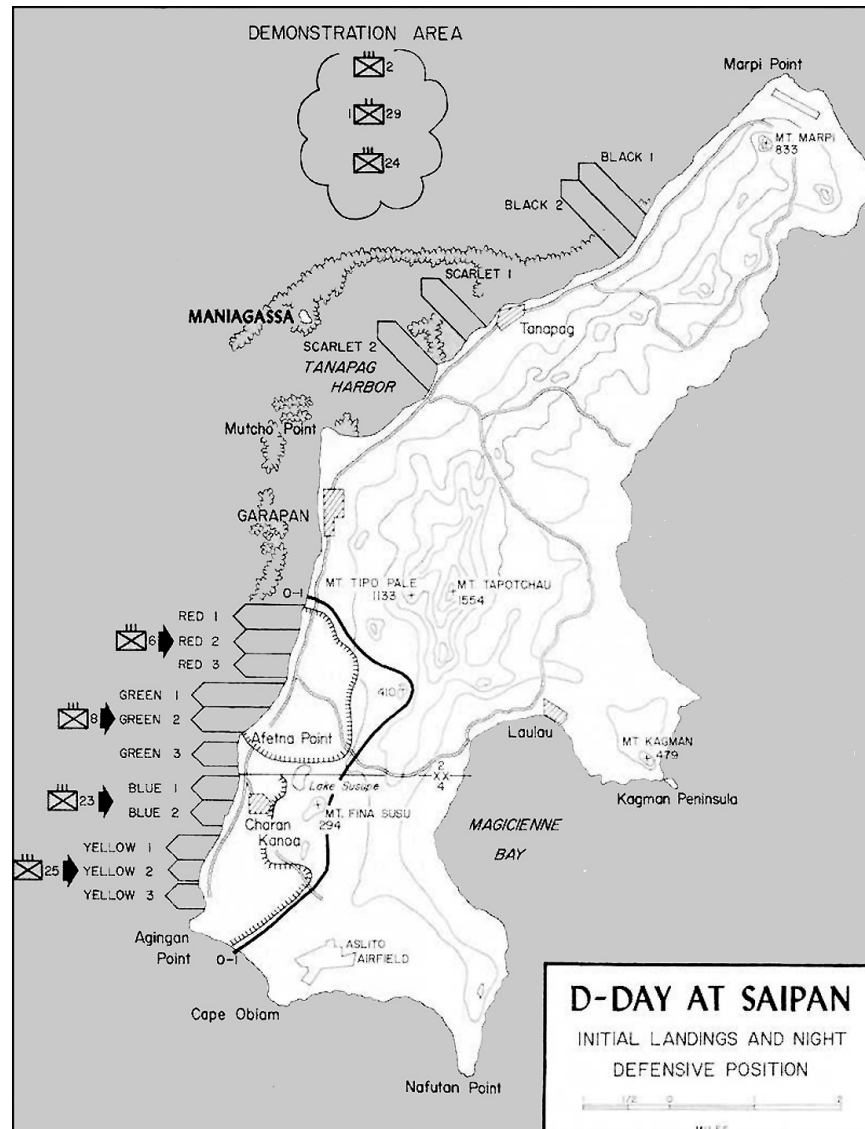


FIGURE 1.2. Map of Saipan with illustrations of the first day of the battle (Image courtesy of ibiblio.org/hyperwar/USMC/USMC-C-Saipan/index.html).

The U.S. strategy for defeating Japan directly hinged on their control of the Marianas. They wanted to use Saipan, along with Guam and Tinian, as bases for the newly developed B-29 “Superfortresses.” This would place them in range of mainland Japan and allow for a strategic bombing campaign to be undertaken. In the months leading up to the invasion of Saipan, there

were a series of air raids conducted by the U.S. Navy (USN) meant to destroy defensive positions around the island as well as the airfields, seaplane base, and the facilities at Tanapag Harbor, located in Tanapag Lagoon. On 13 June 1944 the operation to capture the island began with a fierce pre-invasion bombardment by the U.S. Fifth Fleet. Two days later, on 15 June, the Second and Fourth Marine Divisions as well as the 27th Army Division landed on the shore. By the end of the first day, some 2,000 U.S. troops were dead. This set a precedent of death that would continue for the rest of the battle (FIGURE 1.2) (Gailey 1995).

As the battle bore through the month of June and into July, Japanese forces were pushed into an ever-smaller area, namely the central, mountainous area of the island. Riddled with caves, outcroppings, and crevasses, this terrain proved to be excellent for defensive entrenchment and fortification. U.S. forces had to fight tenaciously for every foot of terrain. Japanese soldiers giving little regard to avenues of withdrawal, chose highly concealed positions that offered excellent fields of fire, thus making them extremely difficult to neutralize. Casualties were the price of every piece of ground captured. Marines and Soldiers gave ominous nicknames such as “Purple-Heart Ridge,” “Death Valley,” and “Hell’s Pocket” to the areas of the most tenacious fighting (Murray and Millet 2000).

On 7 July, the last of the Japanese defenders launched what would amount to be the largest banzai charge of the war. At 0400 in the morning, approximately 5,000 Japanese defenders charged U.S. lines. The fighting raged for hours. The Japanese nearly succeeded in breaking through and were only stopped when artillery fired on them at point blank range. Two days later, the island was declared secure. Of the 32,000 Japanese troops on the island, only 921 were taken prisoner (Gailey 1995, 303). The Japanese had succeeded in killing approximately 3,255 American troops before combat operations ceased (Brooks 2005: 229). Although the island

was declared ‘secure’ there was still a threat from Japanese holdouts. Given the island’s rocky terrain, many Japanese soldiers were able to avoid capture and commenced a guerilla war against the U.S. forces now occupying the island (Hallas 2019) The threat from Japanese holdouts continued through the rest of the war and beyond.

On 6 August 1945, a B-29 named *Enola Gay* took off from the nearby island Tinian and forever changed history when it dropped the first atomic bomb, nicknamed “Little Boy”, on the Japanese city of Hiroshima. Three days later on 9 August, the B-29 named “Bockscar” (also based out of Tinian) dropped a second atomic bomb, nicknamed “Fat Man”, on the Japanese city of Nagasaki (Murray and Millet 2000). The Japanese announced their surrender on 15 August and formally signed the documents on 2 September 1945 in Tokyo Bay aboard the battleship USS *Missouri*. The Second World War was officially over. The last Japanese soldiers on Saipan, under the command of Captain Sakae Oba, surrendered three months later in December 1945 (Hallas 2019).

1.2. *Research Aims and Questions*

The primary goal of this thesis is to document both seaplane facilities at Saipan, their historical significance in the overall Pacific War and their archaeological remains. Furthermore, this research in conjunction with site formation processes was utilized to study the wreck of the PBM Mariner flying boat located on the Battle of Saipan WWII Maritime Heritage Trail in an attempt to identify the aircraft. To accomplish this goal, the following primary research questions will be considered:

1. How and why was the first true forward-area seadrome established at Saipan?
2. What was its contributions and significance to the Pacific War?

3. How and why was the second seaplane facility established?
4. What were the standard operating procedures of these facilities?
5. What archaeological evidence of both facilities still exists today?
6. Can the study of seadromes and their standard procedures, in particular those of the Tanapag Seadrome, contribute to identification of the PBM Mariner wreck located in Tanapag Lagoon?

1.3. Historic and Archival Research

For this thesis, research initially began with an analysis of historic (secondary) sources. There is little documentation of seadromes in the larger narratives of the Pacific Theater as these studies tend to focus on the war in generally broad, strategic terms. Focusing on studies of specific operations, naval battles, or flying boat histories provided more information, but even in these forward-area seadromes, their operations are typically mentioned only in passing. An interview with Bruce Barth, a historian specializing in the history of the PBM Mariner, led to a document titled “Operational History of the Flying Boat: Open Sea and Seadrome Aspects” written by Michael Kammen (Kammen 1959; 1960). Kammen published the two-part study on Second World War seadromes for the Department of the Navy in 1959 and 1960 at the request of the Systems Analysis Division of the Bureau of Naval Weapons. To the author’s knowledge, this is the only academic study of seadromes published thus far.

The analysis focused on seadromes in both the Atlantic and Pacific theaters. It was intended to “...obtain documentary evidence...indicating the over-all reliability and feasibility of operating flying boats in less than reasonably smooth seas... [and to help guide] the direction of research and development toward overcoming various inadequacies of the flying boat” (Kammen

1959: 2). The Kammen report was only intended to analyze the potential of flying boats and seadromes for use as weapons in modern war circa 1958 and not as an all-encompassing historiography. Hence, it was not widely published or distributed. Written approximately 15 years after the end of the Second World War, it is technically a secondary source. All of Kammen's information for the study, however, was taken directly from U.S. military documents and many of these original documents are included in the study's extensive appendices. As such, the report ultimately became the foundation of research for this thesis.

Archival (primary source) materials proved to be the most informative and bequeathed the most pertinent data in terms of both quality and quantity. A great deal of this work was conducted via the Fold3 website (www.Fold3.com), an affiliate of Ancestry.com, which focuses on military documents. All documents found on this source are unaltered scans of originals and contain the location of the document within the U.S. National Archives and Records Administration (NARA) filing system.

War diaries, unit war histories, after action reports, and operational reports were the primary document threads examined through this source. War diaries are a reoccurring report detailing the operations of a specific unit and are usually submitted monthly. A unit's war history is a summary of its operations drawn from personal experiences and war diaries. These usually span from the unit's conception to the end of a conflict or disbanding. After-action and operational reports are summaries of specific actions, tasks, or operations undertaken by a specific unit.

As seaplane tenders were the most crucial component of forward-area seadromes, this was the initial focus of primary source research. The war diaries and histories of all seaplane tenders operating in the Pacific from just before 7 December 1941 through the end of the war

were examined. Their movements and operational details were mapped in order to determine the chronology of forward-area seadrome development. Operations and locations deemed relevant to this study were singled out and thoroughly investigated via an examination of the war diaries, and war histories from the tenders, aircraft squadrons, Fleet Air Wings, and other attached units. This approach was also employed to determine the development, history, and operational aspects of seadrome operations at Saipan prior to, during, and following the battle for the island and continuing through the end of the war.

Research over the span of several days was also conducted at the NARA Archives II in College Park, Maryland. This facility houses most of the official records generated during the Second World War by the military departments of the executive branch of the government. Record Group 38 (RG38), containing the subgroup “Records Relating to Naval Activity During World War II,” was examined to augment research previously conducted through the Fold3 website. Most documents reviewed from this collection had already been examined through Fold3.

Research conducted through Still Pictures Unit at NARA II succeeded in locating numerous photographs relevant to this study from RG80, “Department of the Navy,” and several subgroups. The Cartographic and Architectural Section at NARA II was also visited. There, a series of charts were located in RG 37, “Hydrographic Office Records” that detailed harbor improvement efforts, the seaplane facilities of the Tanapag Seadrome, and the final location of the Garapan Roads Seadrome. Hydrographic Office (H.O.) Field Chart Nos. 2014, 2015, 2015-A were then placed into Esri ArcGIS and georectified. That data was then cross-referenced with documentary evidence in order to reveal where possible cultural material may be located. This was the foundation of a large portion of archaeological field work conducted in July 2019.

1.4. Previous Archaeological Work

Several archaeological surveys have been performed in Saipan that directly relate to the subject matter of this thesis. This began in the 1980s with surveys performed by Michael Thomas and Sam Price of areas inside Tanapag Lagoon which located several sites from the Second World War era (Thomas and Price 1980). The National Park Service conducted several surveys with varying results in 1983, 1984, and again in 1990 with Toni Carrell (Miculka and Manibusan 1983), (Miculka et al. 1984), (Carrell 1991). In 1985, Pacific Basin Environmental Consultants (PBEC) recorded 18 Second World War sites in Tanapag Lagoon alone (PBEC 1985). In 2008, Southeastern Archaeological Research, Inc (SEARCH) conducted a magnetometer and limited SCUBA survey of the west coast of Saipan which identified numerous potential sites (Burns 2008 a.b.). This has since been used as the base dataset for several underwater surveys.

There have been two surveys focused on the Flores Point Seaplane Base that are particularly pertinent to this study. The first was performed by J. Guerrero in August of 1987 for the CNMI Historic Preservation Office (CNMI HPO). Guerrero recorded the Second World War era sites around the former seaplane base, in particular the remaining concrete structures. In this survey report, the entire Flores Point Seaplane Base area was designated as site number SP-1-15-7-0106 (Guerrero 1987). In 2011, David G. DeFant conducted archaeological surveys of the lower seaplane base for a petroleum contamination remediation project (DeFant 2012). Among other aspects, DeFant documented many of the Second World War era structures directly related to U.S. seaplane operations.

The PBEC survey of 1985 contains the first confirmed documentation of an underwater seadrome-related site at Saipan: a Martin PBM-Mariner flying boat located within Tanapag Lagoon. It was not until 2010 that the Mariner's type was positively identified by Dr. Jennifer

McKinnon and Dr. Toni Carrell (2011). McKinnon and Carrell performed surveys in 2011 and 2014 and documented not only the Mariner, but also a PB2Y Coronado wreck located inside the lagoon (McKinnon and Carrell 2011; 2014). Samantha Bell (2010) documented the Mariner site as part of her M.A. thesis in while James Pruitt (2015) performed an extensive survey on a PB2Y Coronado for his M.A. thesis in 2015. McKinnon and Carrell (2015) later published a book on their work titled *Underwater Archaeology of a Pacific Battlefield: The WWII Battle of Saipan* (McKinnon and Carrell 2015).

1.5. Methodology

Historical and archival research led to the identification of several possible sites, both terrestrial and submerged, directly related to Garapan Roads and the Tanapag Seadrome (FIGURE 4.1). Prior to the commencement of field work, semi-accurate coordinates were obtained from the georectified data. This was then used to help guide terrestrial and underwater search surveys. The geographic positions of located sites and/or artifacts were recorded with the use of a handheld GPS system (Garmin 64st). The acquired coordinates were placed into the previously developed ArcGIS project for post-processing. Terrestrial and underwater sites and artifacts were recorded with the use of detail drawings, photography, and video. Measurements were taken with the use of metric tapes as well as a seamstress tape. A variety of photographic scale bars were used for photographic documentation. Underwater surveys were conducted on both snorkel and SCUBA.

1.6. Justification

Forty years ago, Keith Muckelroy, one of the key figures of “New Archaeology,” stated,

“Since the development of the aqualung, divers have undertaken a great deal of work on early steamships, American Civil War gunships, World War 1 battleships, and even World War Two aircraft. But while such enterprises are interesting, and sometimes furnish useful displays for museums, they are not archaeology” (Muckelroy 1980: 10).

This outlook was based in the belief, held by many at the time, that little new knowledge could be obtained through an archaeological examination of sites from the era of the U.S. Civil War forward. If Muckelroy were alive today, he would likely have a very different outlook as it has been proven time and again that a great deal is yet to be learned about these facets of history, especially in the fields of battlefield/conflict archaeology. By employing archival research and archaeological field work, there is now a unique opportunity to give the most complete, accurate account of an event(s) possible.

During wars or conflicts, there is always a great deal of knowledge and information that is forgotten and/or lost; the Second World War is no exception. Some of this can be attributed to the “fog of war,” the chaos of combat causing details to be overlooked, while other aspects were simply not well recorded due to a lack of interest at the time. Forward-area seadromes are an excellent illustration of this. While documentation exists of where they were and some of their standard operating procedures, the information scattered throughout the archival record and has not been thoroughly investigated. The same applies to the permanent seadrome and seaplane base later constructed inside Tanapag Lagoon and ashore at Flores Point.

This thesis will be the first detailed study of the Saipan seadromes and will attempt to fit their importance within the wider evolution of other Pacific War seadromes and their contributions to the war. Numerous seaplane bases and seadromes were established by the U.S. Navy across the Pacific during the Second World War. Archival research indicates that the seadrome established offshore of Saipan on 17 June 1944, however, appears to have been unique in the Pacific Theater up to that point, as this facility was the first to be placed in such close proximity to a major combat operation and without any terrestrial components. Furthermore, it appears to have been forged out of improvised necessity rather than preconceived design. The end product of this experiment was incorporated into most strategic plans through the remainder of the war.

Augmenting this will be an analysis of the construction of permanent terrestrial and water-born facilities inside Tanapag Lagoon. This appears to have been a unique situation in the Pacific Theater where an active seadrome operation was ongoing while a major seaplane base was being constructed by the same unit in the same location. This required post-battle salvaging operations, dredging, accurate underwater and terrestrial surveys, extensive construction projects, and several instances of trial and error. This was an enormous undertaking and only possible with close cooperation between various units of different specialties (ratings). From both archaeological and historical standpoints, a keen understanding of the functions of one facility will help with the understanding of the other as the procedures and machinery were similar if not the same from one to the other.

The PBM-Mariner and the PB2Y Coronado wrecks inside Tanapag Lagoon are both directly linked to the wartime seaplane operations conducted there. The histories of the PB2Y Coronado, the PBM Mariner, and the Saipan seadrome are intertwined. One cannot fully convey

the history of either aircraft without including their attachment to the seaplane base and vice-versa. A detailed study of the Saipan seadrome will further solidify their importance in the archaeological and historical record of the Battle of Saipan and the overall Pacific War.

Perhaps most crucial to justifying the archaeological component of this thesis project is the fact the Second World War sites are perpetually deteriorating. While some have been “stabilized,” the natural processes of deterioration are still etching away at their existence. In Saipan, this is compounded by disturbances to the sites caused by visitors. This ranges from basic physical contact with artifacts to nefarious looting. Some of the factors will continue to take their toll on sites; therefore, delaying investigation only increases the chances of the permanent loss of historical data.

1.7. Limitations

Prior to presenting the data analyzed in the proceeding chapters, a number of limitations must be acknowledged. First, as opposed to many other studies for which records are somewhat scarce and can be difficult to locate, this study was hindered by the sheer volume of data to be analyzed. Thousands of documents and document threads had to be examined in order to piece together the related material for this study. Therefore, it is possible that documents pertinent to it were overlooked. Augmenting this hurdle is the fact that there was not a standard for the amount of detail included in records at the time. Quality of the recorded data was largely dependent on the author. Some units maintained excellent, detailed documentation while that of other units were vague.

Second, surveys conducted during fieldwork encountered some limitations. Site accessibility was hindered by vegetation and terrain rendering some terrestrial locations

inaccessible. For underwater surveys, the use of a dive boat was arranged prior to the beginning of field work. Only two dives and one snorkel survey (less than half of what was initially planned) was undertaken due to boat access issues.

Chapter 2 Background

2.1. Basic Concepts

While a floatplane, seaplane, and flying boat are all aircraft that can take off and land on water, there are distinct differences between them. A floatplane is a terrestrial-based aircraft design that has been reconfigured with floatation devices, usually in the form of pontoons, suspended under the wings and/or fuselage. The fuselage of the aircraft never comes in contact with the water. A seaplane, on the other hand, is built so that the fuselage itself acts as the aircraft's floatation. A flying boat is simply a larger seaplane that is capable of carrying passengers and cargo. This aircraft usually resembles a boat with wings, hence the name. Often times, floatplanes are deemed seaplanes when used in an ocean-based role. Although it makes sense from a design standpoint, it is technically not correct.

The concept behind the seaplane tender is a logical one: if an aircraft can land, take off, taxi, and moor on the water, it can be serviced on the water. This saves terrestrial space and allows for efficient transportation and storage of the provisions, fuel, and armament that a naval seaplane requires. Aircrew and maintenance personnel can be berthed aboard the tender and operate from it for extended periods of time. A tender can be anchored near runways and aircraft moorings giving it a vantage point of air operations similar to that which a control tower possesses on a terrestrial airfield.

Further cementing the necessity of tenders is the fact that flying boats are not easily brought on to land. In most models beaching gears (removable wheels) must be attached to the hull before rolling the plane on to solid ground. This can be a tedious process and one that is exceedingly difficult in cold or rough water. The main issue with tender-based operations, however, is that servicing a floating aircraft from a small boat is much more difficult and time

consuming than servicing one that is sitting on land. Not only does a mechanic have to balance himself with one hand whilst working with the other, but the dropping of a tool or part could prove disastrous as opposed to a minor inconvenience. This meant that until water-based maintenance operations could be made efficient, tenders were used almost exclusively in conjuncture with established terrestrial facilities.

The term “seadrome” refers to the water-based areas of a seaplane base where aircraft and their tender ships operate. These include runways, taxiing routes, moorings, and servicing areas. The name is originally derived from the British “aerodrome” which defines the grounds, facilities, and airspace of an airfield (Chorlton 2014). All seaplane bases will have a form of a seadrome, but a seadrome does not necessarily have to be attached to a seaplane base.

Seaplane bases have terrestrial components in the form of administrative offices, maintenance facilities, and operational control. Should those aspects be placed aboard a mobile platform (i.e. a seaplane tender) operations can be conducted from anywhere given the proper weather conditions. In the absence of a terrestrial tether, the ships and planes are no longer a seaplane base, but rather a mobile seadrome. Excluding the need for fuel, provisions, and major aircraft overhauls, seadromes can operate for an indefinite period of time should the situation require it. Research indicates that this notion was developed gradually beginning in the WWI, through the inter-war years, and into the Second World War finally culminating at Saipan in June 1944.

2.2. Theoretical Developments

The foundations for forward-area seadrome operations were initially laid in the WWI during the Dardanelles Campaign. Floatplanes of the British Royal Naval Air Service (RNAS)

launched from the tender *Ben-my-Cheree* (a converted collier) carried out the first recorded aerial torpedo attack in history scoring a hit on a Turkish ship at anchor (Corbett 1923: 102). Other operations conducted by the RNAS at that time included reconnaissance, anti-submarine and anti-mine patrols, as well as instances of air-to-air combat and ground attack missions. The primitive construction of aircraft at the time meant that the RNAS biplanes could not be permanently moored on the water and, instead, had to be hoisted on to their tenders between missions via a large crane. In addition to this inconvenience, sea conditions had to be of an ideal height in order for the underpowered aircraft to take off: swells too little and the aircraft could not break free from the suction of the sea, swells too high and the flimsy wire and canvas structure would fail and/or the aircraft would be swamped (Pavelec Interview HistoryHit 2016). These hindrances greatly diminished the effectiveness of forward seaplane operations at the Dardanelles. As a result, their potential was never fully explored by the British in the years to follow.

Throughout the 1930s, war clouds began to gather on the horizon. While the forthcoming 7 December 1941 Japanese attack on the U.S. fleet at Pearl Harbor was a tactical surprise, the conflict itself was foreseen years in advance by military minds. “Prior to the President’s Proclamation of the limited national emergency on 8 September 1939, relations with Japan indicated a need for an efficient long rang air scouting force and also a well-trained air striking force in event of attack. The security of the fleet units and bases would further require patrols to be conducted in certain areas at certain times” (Patrol Wing Two/Fleet Air Wing Two War History 1945: 11). The war took place across the Pacific Ocean, having “a surface area of nearly 64 million square miles...greater than the combined landmasses of the entire earth” (Stavridis 2017: 121). It was unlike any in war history and required an entirely new approach. To that end,

the USN revamped its approach to patrol aircraft in the mid to late 1930s by reorganizing its patrol plane forces, adopting new types of flying boats, and developing a fleet of seaplane tenders to service them.

2.3. Organizational Aspects

In the late 1930s, the USN completely reevaluated its fleet of patrol aircraft. The number of planes per squadron varied based on the type of plane, availability, and the task-at-hand. A PBM-Mariner tactical squadron (the aircraft of focus for this study) typically had twelve to fifteen aircraft and crews with three spare aircraft on hand. Squadrons, flying both seaplanes and land-based aircraft, fell under the command of a Patrol Wing (PatWing). Several PatWings were commissioned and were distributed geographically. For example, PatWing Two's area of operations included the Hawaiian Islands, PatWing Four's area of operations included the Northwest Coast of the U.S. and the Alaskan Territory. Each PatWing was independently administered and controlled from within. This allowed for efficient distribution of squadrons and personnel as the situation required ((Patrol Wing Two/Fleet Air Wing Two War History 1945).

In November 1942, PatWings were reorganized yet again into Fleet Air Wings (FAWs). Each FAW maintained its original number (i.e. PatWing Two was now FAW Two), but also had "...increased mobility of squadrons, flexibility of organization, economy of maintenance personnel, and economy in use and efficiency in distribution of material" (Patrol Wing Two/Fleet Air Wing Two War History 1945: 14). Each FAW had a headquarters squadron, tactical squadrons, rescue squadrons, and photographic squadrons. The three predominate flying boats in each FAWs arsenal were the PBY Catalina, the PB2Y Coronado, and the PBM Mariner, all introduced at the height of the prewar build up.

2.4. PBY-Catalina

Consolidated's PBY Catalina flying boat first saw service in 1936. The Catalina had two engines, a wingspan of 104 feet (ft), a height of 20 ft, and a length of nearly 63 ft. It was issued in a number of variants up to and throughout the Second World War but the basic airframe remained largely unchanged. Most variants had a range of between 2000 and 2500 miles (mi) with a gross weight of between 25,000 and 35,000 pounds (lbs.) (Creed 1985). The most sought after of these variants was the PBY-5A. A true amphibian, the PBY-5A had retractable wheels that allowed it to operate from land as easily as it could from water.

2.5. PB2Y-Coronado

In 1939, the USN purchased six Consolidated PB2Y Coronados. These were the first of four variants (PB2Y-2, PB2Y-3, PB2Y-4, and PB2Y-5) delivered to the USN throughout the war. The four-engine flying boat was large and pudgy with a wingspan of 115 ft. Depending on the variant, the Coronado had a gross weight between 57,630 lbs. and 76,000 lbs., a range between 2,310 mi and 3,110 mi, a defensive armament of between five and eight .50 caliber machine guns (some in double mounts at the nose and tail) (Pruitt 2015). The two critical flaws with the Coronado were its cost and its size. A single Coronado cost approximately \$300,000, roughly the same price as three Catalinas. Furthermore, since the Coronado had four engines as opposed to two, maintenance time and fuel demand were greatly increased. Nevertheless, the Coronado served with distinction during the Second World War in combat, rescue, and transport roles (Pruitt 2015).

2.6. PBM Mariner

PBM Mariner was a medium, twin-engine flying boat designed to fill the operational gap between the PBY and the PB2Y. It became the primary aircraft of choice for forward-area seadromes. Manufactured by the Glenn L. Martin Company the first PBMs were delivered to the USN in 1940 (Hoffman 2004). Numerous variants of the Mariner were produced throughout the Second World War and designed for specific tasks from patrol bombers to rescue operations. All USN PBMs had the same basic airframe with a wingspan of 118ft, a height of approximately 27.5 ft, and a total length of approximately 80 ft (Ginter 2013, 37). Depending on the variant, the Mariner had a gross weight between 40,513 lbs. and 58,000 lbs., a range between 1,000 mi and 3,650 mi, and a defensive armament of between four and six .50 caliber machine guns (Ginter 2013). PBM Mariners first saw combat in the Pacific operating from Tarawa Atoll in the Gilbert Islands with Patrol Squadron (VP) 202 in early 1944 and saw some successes, but it was not able to reach its full potential until the PBM-3D patrol bomber variant arrived at Saipan in the hands of VP-16 pilots in mid-1944.

The PBM-3D had numerous improvements over previous variants. Stronger, fixed, strut-mounted wing floats replaced weaker retractable ones and bomb capacity was increased by enlarging the nacelles. Powered turrets were located in the nose, top deck, and tail, all with dual .50 caliber machine guns in powered turrets. Single gun mounts of the same caliber were also on both sides of the waist. Armor was added for better crew protection and 1,600 hp Wright R-2600-6 engines were replaced with the larger Wright R-2600-22 engines producing 1,900hp sporting four-bladed propellers. A powerful AN/APS-15 airborne radar system was aboard with its antenna mounted in a large elongated dome mounted immediately atop and aft of the cockpit. The aircraft was separated into two levels and five water-tight compartments. “Maximum speed

was about 215 miles per hour; fuel capacity with droppable bomb bay tanks was 3,496 gallons and the range was [approximately] 2,400 miles” (Hoffman 2004: 6). As offensive armament the PBM-3D could carry 8-500 lb. bombs, 8-325 lb. depth charges, 2-Mark 13 torpedoes, or 4 – Mark 13 sea mines (Ginter 2013: 42).

The chief problem that plagued the PBM-3D series was a lack of power, even with its larger engines. Although the engines would suffice to get the Mariner airborne, they would struggle to do so when the aircraft was fully laden. This handicap was compounded when weather conditions were less than ideal. As a sea-rescue aircraft, the PBM-3D was “...inherently unfit for open sea landings and take offs, even under ideal conditions” (Fleet Air Wing One Action Report, 10 September—15 October 1944: 3).

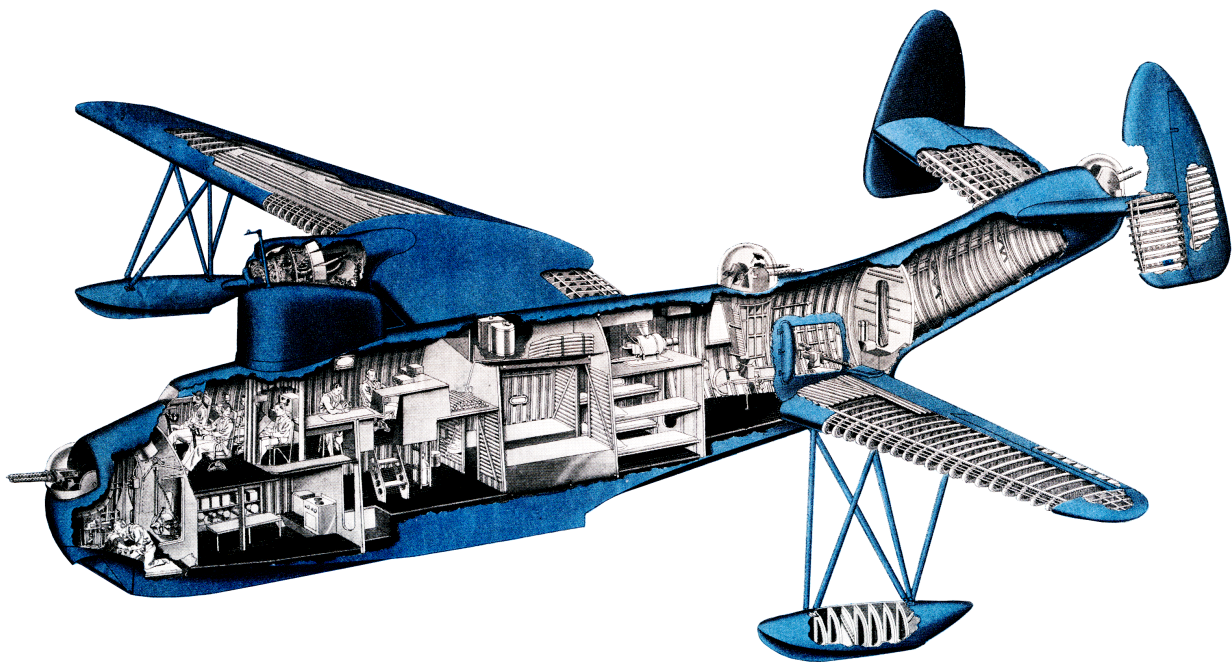


FIGURE 2.1. Interior layout of PBM-5, very similar to PBM-3D (Image courtesy of weaponsandwarfare.com/2019/01/16/martin-pbm-mariner/).

The initial solution was to replace the engines with more powerful Wright R-3350, each producing 2,200 hp. This variant was designated the PBM-4, however, the war department

redirected all Wright R-3350 engines toward production of the new B-29 Super Fortresses and the project was scrapped before a prototype was built (Hoffman 2004:8). Instead, Martin chose the slightly smaller 2,100 hp Pratt and Whitney R-2800-22 engines. The engines of most PBM-3s already in service were swapped out for these thus solving the power issue. Mariners rolling out of the factory with new engines were designated as the PBM-5 variant. They began to arrive at units in mid-1944 (Hoffman 2004) (FIGURE 2.1).

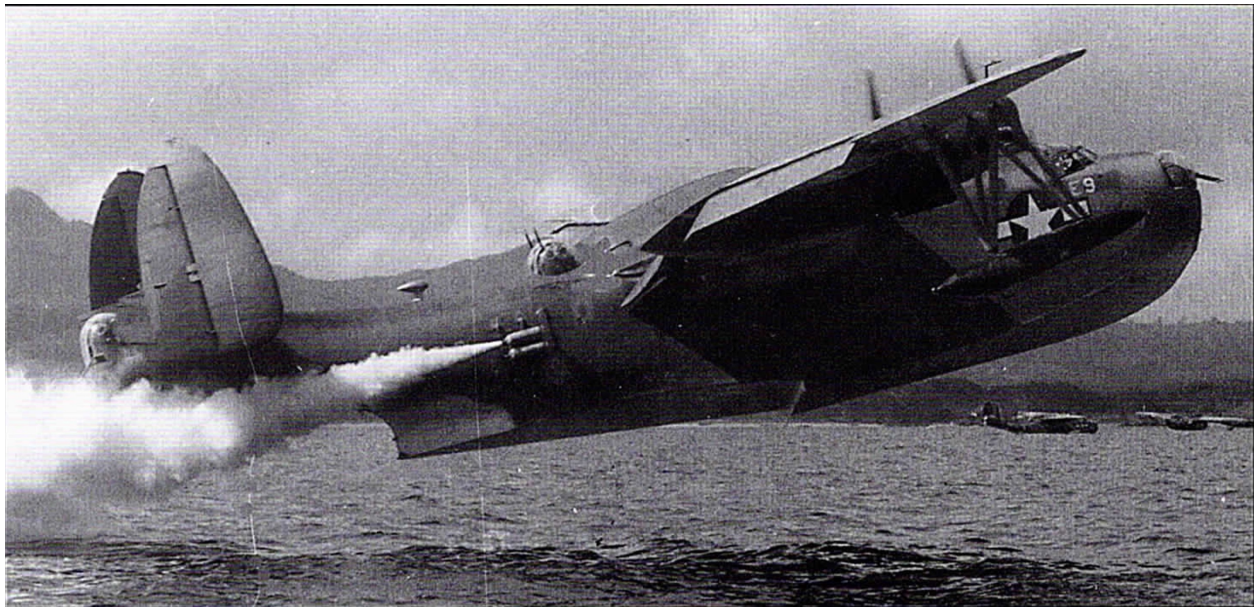


FIGURE 2.2. Original caption: "VBP-27 PBM-5 E9 also at Kerama Retto making a JATO take-off on 8 August 1945 (Image courtesy of Ginter, Steve. "Naval Fighters Number Ninety-Seven: Martin PBM Mariner" Page 173).

Around the same time, the introduction of jet-assisted take off tanks (JATO)s further alleviated the power issues of the PBMs. JATO)s were self-contained fuel units consisting of a solid rocket fuel inside a steel cylinder with a narrow nozzle at one end. Two JATO units were mounted on the outside of each waist hatch (four in total) and were individually ignited by the pilot via an electrical switch. Each JATO tank produced 1,000 lbs. of thrust for a duration of twelve seconds (Kammen 1959: 41). Theoretically, this cut the space required for lift-off in half.

Empty JATO cylinders were jettisoned soon after the aircraft was airborne and could be replaced simply by opening the hatch and mounting fresh units (FIGURE 2.2).

Ultimately, 3,290 PBY Catalinas, 217 PB2Y Coronados, and 1,300 PBM Mariners were delivered to the USN (Creed 1985). The Catalina was the most utilized in the first years of the war. Hence, as a new fleet of USN tenders were being developed at this time, it was used as a design standard for many aspects aboard the vessels. This would later prove to be a frustrating hurdle which maintenance crews had to overcome in the future when servicing Mariners in Saipan.

2.7. Seaplane Tenders: Sailing Airbases

The history of U.S. naval aviation in the inter-war years centers heavily on the development of aircraft carriers, but it is telling that the same year (1921) the U.S. commissioned its first aircraft carrier, USS *Langley* (CV-1), (which was later converted to a seaplane tender in 1937) it also launched its first aircraft tender, USS *Wright* (AV-1). Although initially designed as an airship tender, *Wright* was converted to a seaplane tender in 1926 (Owen 1994:25). The trend of converting ships for use as seaplane tenders persisted for decades, even after the introduction of purpose-built vessels. The USN was slow to adopt flying boats and tenders into their arsenal and their numbers remained relatively few until a decade after the commissioning of USS *Wright* when several new lines of seaplane tenders joined the fleet in the late-1930s. Some tenders were purpose-built ships while others were converted from the existing hulls of various classes and types.

Two purpose-built ships (*Curtiss* class) were ordered in 1937 and commissioned as AVs in 1940. Soon after, four improved *Curtiss* class tenders, known as the *Currituck* class, were also

ordered, but these were not completed for several years (FIGURE 2.3). To boost the USN's numbers of large tenders immediately, seven C-3 merchant hulls were converted into large tenders shortly after being launched. Each C-3 conversion was 492 ft long with a displacement of 14,200 tons and could carry 300,000 gallons of aviation fuel. They were equipped with a crane cable of lifting seaplanes (specifically the Catalina) out of the water and on to the deck for maintenance (Hoffman 2014). Several motor launches and bowser boats were also attached to each ship. These nimble boats allowed for minor aircraft maintenance and flight preparation in calm waters as the AVs were too cumbersome to be easily maneuvered around a harbor or seadrome.

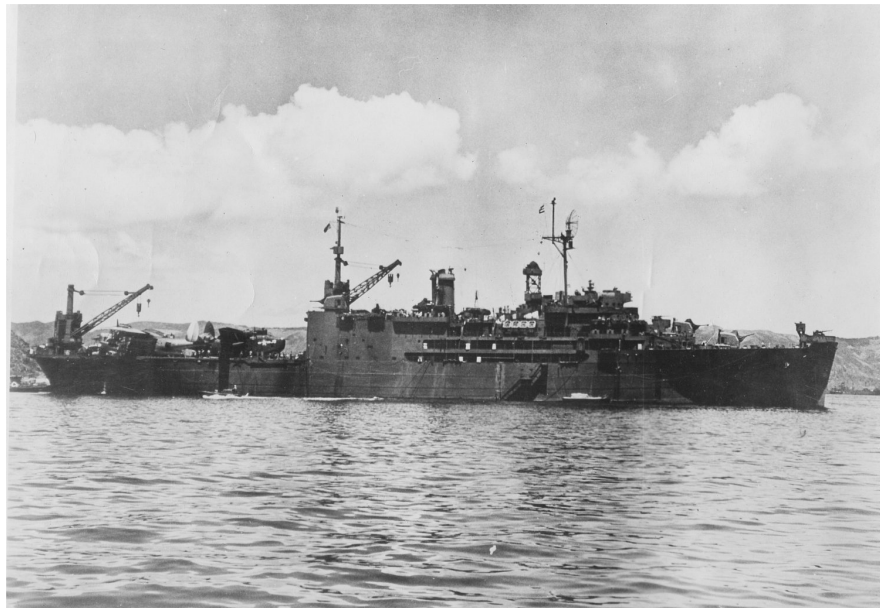


FIGURE 2.3. USS *Norton Sound* (AV-11), a large Currituck-class tender (Image courtesy of Navsource.org/archives/09/41/4111.htm).

On board these larger ships were facilities allowing them to be self-sufficient for extended periods of time. These included storage for bombs and torpedoes, machine shops, sophisticated radio and radar facilities, an air plot (where air operations are coordinated), an aerology department, a photographic laboratory, a parachute packing compartment, a hospital, a

print shop, “ready rooms” where pilots would receive their pre and post-flight briefings, as well as quarters for the ship’s crew, maintenance crews (called “patrol service units” [PATsUs]), and aircrew (Owen 1994). In order to save space, aircraft engines and armament were brought aboard in pieces and assembled on site. Torpedoes were especially detested by the assembly teams as it was claimed that they had “5,555 parts” (Owen 1994:17). As they were ideal transport and assembly platforms, many of the seaplane tenders would be relegated to being cargo transports in the early years of the war when merchant ships were few in numbers (FIGURE 2.4).



FIGURE 2.4. USS *Pocomoke* (AV-9), a C-3 Merchant Conversion class tender (Image courtesy of Navsource.org/archives/09/41/4109.htm).

A fleet of smaller tenders were introduced as well. These were able to get underway faster than the larger ships and had a shallower draft making them better suited for maneuvering around a seadrome as well as being ideal for use as emergency response craft. In 1936, nine

small *Bird*-class minelayers of WWI vintage were converted into tenders (AVPs) (Hoffman 2004: 175). Each ship was designed to support six aircraft and carried 30,000 gallons of aviation fuel. Also brought out of the mothball fleet and converted into seaplane tenders were 14 WWI era “four-piper” destroyers. Seven of them were reclassified as AVPs while the other seven were reclassified as “seaplane tender, destroyers” (AVDs) with the main difference being that the AVDs retained some of their armament, specifically the bow gun. “They were trim vessels, 318 ft long, with a limiting displacement of 1,900 tons...they were capable of twenty-five knots and were equipped to service twelve patrol planes” (Hoffman 2004:177).

Photo # NH 97672 USS Onslow at Saipan on 22 June 1944



FIGURE 2.5. USS *Onslow* (AVP-48), A *Barnegat* class seaplane tender at Saipan (Image Courtesy of NavSource.org./archives/09/43/4348.htm).

Beginning in 1938, the purpose-built *Barnegat* class AVPs began to roll out of shipyards. These were 311 ft long, with a 41 ft beam, capable of eighteen knots and had a displacement of 2,800 tons and an 85,000-gallon aviation fuel capacity. Like the larger AVs, the *Barnegat* class had extensive repair and supply facilities and were designed to support up to a full squadron.

They did not have a crane capable of hoisting a flying boat out of the water and on deck, but were equipped with several refueling, rearming, and personnel boats that could handle basic servicing of aircraft in good weather conditions (Hoffman 2004). Each *Barneget* class tender could berth six PBM flight crews (FIGURE 2.5) (Guttman 2004).

Typically, seaplanes would be moored inside the seadrome, fully fueled and (in wartime) armed. When it was necessary for a tender to command and orchestrate the activities of a seadrome or seaplane base, one ship would be designated as “Seadrome Control Tender.” This ship would control the movement of men, materials, and aircraft around the seadrome as well as monitor radar, wireless communications, and conduct air traffic control. On the nearby terrestrial facility there would usually be an additional control tower that would facilitate traffic coming to and from the shore. Each tender would have aboard a PATSU crew, specifically assigned to the task of maintenance for the aircraft attached to their tender. The PATSUs rotated on and off the tenders similar to combat aircrews being pulled on and off combat patrols (though not on the same schedule). Pilots received their orders in the ready rooms aboard their tender and then the aircrews departed the ship via motor launch and be transported to their awaiting plane. Once aboard and cast-off, they taxied to a runway, which was previously cleared of underwater obstructions, and took off on their missions.

2.8. Conceptual Development of Forward-Area Seadromes

The USN did establish some terrestrial seaplane bases in forward areas early in the war, mostly in the Southern Pacific. These were usually small reconnaissance bases that also could be used as stopping points for the Naval Air Transport System. Typically, an island devoid of Japanese defenders and with a sheltered bay was chosen. Seabees cleared a small patch of land

and built a seaplane ramp. Once feasible, aircrews, their flying boats, and PATSUs were brought in to begin air operations. As the front lines moved farther and farther away, the base began to lose its strategic value. Construction continued on the facility until the day crews were told to disassemble what they could and demolish everything else as the materials and personnel were moved closer to the front and a new facility was built. This method was both time consuming and costly. Clearly, a more efficient method for front line seaplane operations needed to be developed (Department of the Navy, Bureau of Docks and Yards 1947).

Forward-area seadromes are meant to be semi-mobile seaplane bases established in relatively close proximity to the enemy; the true purpose being to augment a strategically offensive operation. Both the technological and operational aspects of this first manifest during the Aleutians Campaign. The Japanese had captured the remote islands of Attu and Kiska, part of the U.S. territory of Alaska, in June 1942. A bombardment of Kiska was to take place on 7 August 1942. USS *Casco* (AVP-12) set up a small seaplane anchorage in the sheltered Nazan Bay at Atka on 19 July 1942 in order to cover this bombardment task force. PBY Catalinas based on *Casco* maintained a defensive screen for the ships, conducted harassing bombing missions, and performed last-minute photographic reconnaissance missions over the island. Conditions here were ideal for seaplane operations as the waters were calm and secluded. Japanese bombers harassed the anchorage from time to time, but enemy soldiers were not on Atka and so regular missions could proceed largely unmolested. Later, a Japanese submarine succeeded in putting a torpedo into *Casco* while still at Nazan Bay, but the ship remained afloat and was repaired (Fleet Air Wing Four, War History 1945).

Casco later participated in the invasion and recapture of Attu. On 12 May 1943 the ship established a seadrome in the sheltered harbor there and serviced reconnaissance PBYs along

with battleship and cruiser-based planes (Fleet Air Wing Four, War History 1945: 59). Aircraft were used for long-range artillery spotting during the Second World War both on land and at sea. Every big-gun ship had a spotter plane. These were usually a small, single-engine seaplane that was launched from the ship's deck via catapult. The aircraft landed on the water and was recovered by its parent ship via crane when either the mission was completed or the aircraft was running low on fuel. Aircraft recovery was a time-consuming process that required a ship to halt its firing, change course to suit the aircraft's safe landing on the ocean, recover the plane, refuel, rearm, and relaunch it before being able to continue targeting enemy positions. By giving the task of servicing spotter planes to a nearby tender, the turn-around time was cut down exponentially. A pool of available planes also meant that the loss of one did not handicap the parent ship as another could be easily requisitioned. This allowed for battleships and cruisers to continue their bombardment of enemy positions uninterrupted.

Tending for spotter planes occurred again in mid-February 1944 during the invasion of Eniwetok Atoll. A temporary seaplane base with limited facilities was established in a sheltered lagoon six miles south of Engebi Island on the first day of the invasion (D-Day). *YMS 383* (an auxiliary minesweeper) was designated as the Seaplane Headquarters Ship with the senior aviator of the cruiser *USS Portland* (CA-33) aboard as Commander of Seaplanes. It was an improvised operation. Eighteen seaplane moorings were laid out, but because of an insufficient number of buoys, weighted 20-mm ammunition cans were used instead. Spotter planes at Eniwetok not only responded to requests from battleships and cruisers, but also destroyers (which had no spotter planes of their own) thus greatly increasing the effectiveness of the smaller ships. While the operation was a success, the lack of repair and refueling facilities and insufficient radio equipment aboard *YMS 383* somewhat handicapped performance. The concept

was proven sound and brought praise, but it was highly recommended that a small tender designed for the specific task be available for future operations (Commander Battleship Division Two, Action Report of Bombardment of Eniwetok Atoll: 28 February 1944).

The next step in the Central Pacific island-hopping campaign was aimed at the Marianas. During the Marshall Islands campaign, the U.S. bypassed several islands and pushed deep into Japanese territory to attack and capture the center for Japanese control of the region, Kwajalein Atoll. The U.S. strategy for the Marianas was similar in that it called for the invasion force to bypass Guam and Rota to attack the Japanese administrative hub of the region, Saipan. This would leave the U.S. invasion force in a precariously exposed position far away from land-based air cover and vulnerable to a Japanese naval counter-attack. Military planners decided, however, that this was a risk worth taking. The Imperial Japanese Navy was not still considered the threat that it had been two years prior and Saipan was predicted to be fully captured within three days (Hallas 2019). The facilities to operate land-based and seaplanes were then placed into working condition and the aircraft were brought up from the rear area in short order. This over-confident prediction would later prove a dangerous miscalculation.

Chapter 3 History

3.1. Plan A-Go and the Establishment of Garapan Roads at Saipan

The Japanese knew that the U.S. would make another thrust into their territory in 1944, but between Palau, the Western Carolinas, and the Marianas, they did not know where. The First Mobile Fleet under the command of Vice-Admiral Jisaburo Ozawa was to meet this attack when it finally came. The First Mobile Fleet was a steel leviathan of nine aircraft carriers, five battleships, 13 cruisers, 28 destroyers, and some 500 aircraft (Tillman 2005: 101). Even with such a powerful force, at this stage of the war there were no longer any disillusionments of the strategic situation; Japanese forces lacked numerical and material superiority and they could not easily replace any losses they would suffer. Taking this into account, Ozawa and the Japanese high command developed Operational Plan “A-Go” (Cleaver 2017).

The Japanese plan was to keep the First Mobile Fleet in local waters near their fuel sources at Borneo and Sumatra until the U.S. began another offensive. The fleet was then to lure the U.S. Fifth Fleet towards them, far enough away from the invasion force to effectively render the invasion force left at Saipan unprotected. The Japanese carriers were then to launch strikes upon the Fifth Fleet from greater distance than would allow their pilots to return to the carriers. Instead, after their attacks upon the U.S. carriers the Japanese pilots were to continue on landing at terrestrial bases in the Marianas to be rearmed and refueled before turning around and conducting secondary attacks against both the invasion force and the Fifth Fleet on the return flight. Incorporating the terrestrial bases in the plan allowed Ozawa to extend the range of his carriers, thus keeping his fleet distant enough from the U.S. force so as to avoid a counter-strike (Cleaver 2017).

On 29 May 1944, in accordance with Operation Plan 4-44, USS *Ballard* (AVD-10) was ordered from Pearl Harbor to Eniwetok Atoll to join Task Force 52, part of the U.S. Fifth Fleet assembling there (*Ballard* War Diary: May-June 1944). As the most forward U.S. base in the Central Pacific at that time, Eniwetok stood on the frontier of the vast ocean and Japanese-controlled territory beyond. The atoll was the ideal staging area for the next major U.S. thrust into the Central Pacific: the invasion of Saipan, code-named named “Operation TATTERSALLS” (part of the larger “Operation FORAGER”). Dog Day (“D-Day” the military designation indicating the starting date of an invasion) was slotted for 15 June. *Ballard*, having arrived at Eniwetok on 8 June, was attached to Task Group 52.7: Service and Salvaging Group (TG 52.7) (CINCPAC Report of Operations in the Pacific Areas, 1 June to 30 June 1944, Annex A, 5).

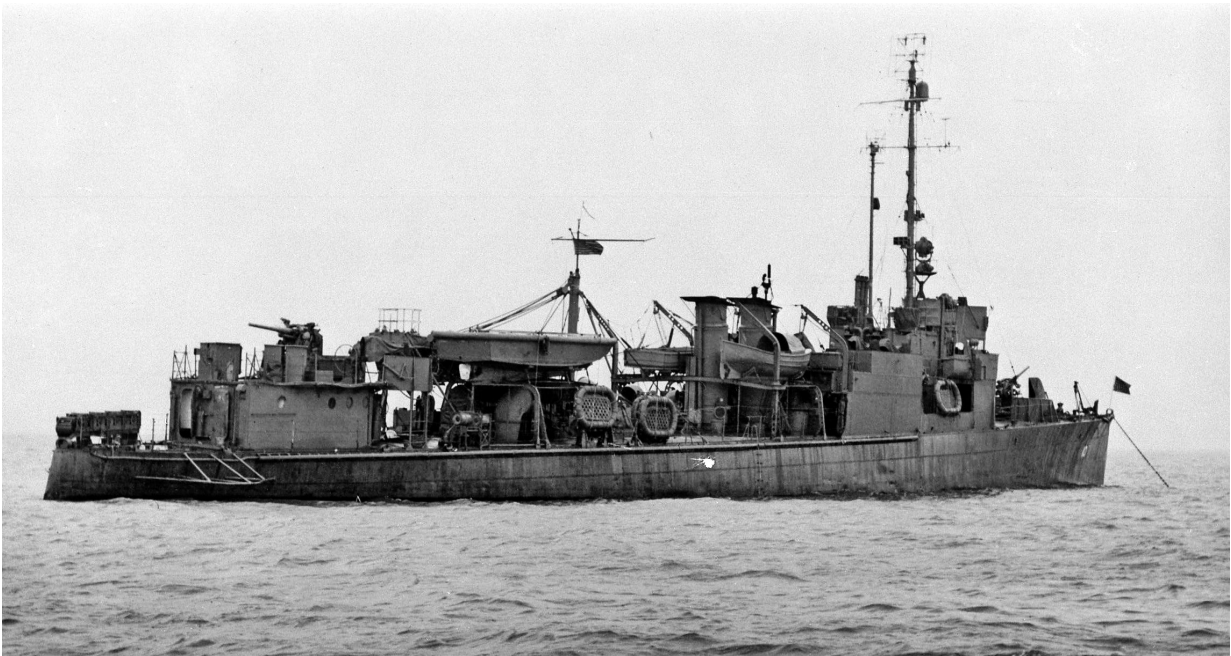


FIGURE 3.1. Stern view of USS *Ballard* (AVD-10) (Image courtesy of Navsource.org/archives/09/56/5610.htm).

Although documents detailing *Ballard*'s precise purpose for joining the invasion force have not yet been located, it can be surmised that the ship was intended to undertake the

establishment of a seadrome inside the island's sheltered body of water, Tanapag Lagoon, as soon as practicable. This required operating in conjunction with salvaging vessels to clear the waters for other tenders and aircraft operations, hence *Ballard*'s inclusion with TG 52.7.

Furthermore, *Ballard* would be on hand to service the fleet's spotter planes in accordance with the operational doctrines developed at Eniwetok and the Aleutians. This is also evidence that the open-roadstead seadrome established at Saipan was entirely (or very nearly so) unplanned ahead of time. Had it been foreseen that flying boats were to operate off shore at Saipan, a larger AV or purpose-built AVP would have been chosen for the task instead (FIGURE 3.1; FIGURE 3.2).

Also ordered forward to the Eniwetok staging area was a detachment of six PBM-3Ds of Patrol Squadron (VP) 16. VP-16 was formed at Naval Air Station (NAS) Harvey Point, North Carolina in December 1943 and were the first whole squadron to be issued the new PBM-3D patrol bomber variant of the Mariner. VP-16 was based at NAS Kaneohe on Oahu as a part of FAW Two. Following the complete capture of the island (on the aforementioned timeline of three days) the Mariners of VP-16 were to conduct mail-runs and transport duties out of Tanapag Lagoon, eventually becoming part of a permanent patrol squadron stationed there. Upon landing at Eniwetok, the Mariners of VP-16 were attached to Group One, Fleet Air Wing Two. *Ballard* and the rest of the Task Force 52 sailed for Saipan on 11 June (USS *Ballard* War Diary: June 1944).

In response to the mobilization of the U.S. fleet, Admiral Ozawa ordered the First Mobile Fleet underway on 13 June and set a course to intercept U.S. forces on the far side of the Philippine Sea. Going into most battles prior to this, the allies were keenly aware of the details of Japanese plans owing to the efforts of U.S. code-breakers' ability to read Japanese radio-traffic. Under the suspicion that the allies obtained copies of these codes following the capture of one of

their senior officers, the Japanese changed their naval codes prior to the sailing of the First Mobile Fleet. This left U.S. code-breakers unable to decipher Japanese radio messages. Further complicating matters, Ozawa ordered strict radio silence thus making triangulation of their position impossible (Cleaver 2017). U.S. submarines were able to give piecemeal intelligence as to the location and sailing direction of the Japanese force through sporadic sightings, but were unable to maintain pursuit and contact. It must be noted, however that the submarine USS *Albacore* succeeded in attacking the newest Japanese carrier, *Taiho* (Ozawa's flagship), with a single torpedo that eventually facilitated its sinking (Cleaver 2017).

Ozawa's counterpart was Admiral Raymond Spruance, Commander of the U.S. Fifth Fleet. The victor at the Battle of Midway, he was later criticized for being too cautious in not aggressively pursuing the enemy. In hindsight, this decision likely saved the U.S. fleet from ambush and destruction (Cleaver 2017). Two years later, Spruance was leery yet again. The admiral knew that the First Mobile Fleet was sailing but their exact location, tactics, and ultimate target was unclear. The Japanese could seize the opportunity to attack virtually anywhere in the Pacific or, if they chose to attack the U.S. invasion fleet at Saipan, they could approach from virtually any direction. Spruance needed eyes scouring the Philippine Sea. Eniwetok was the closest airfield that could support heavy patrol planes but it was too far to conduct reconnaissance in the necessary areas (Hoffman 2004: 180). Furthermore, carrier-based aircraft only had a range of between 900 and 1,200 nautical miles round trip (Cleaver 2017). *Ballard's* presence with Task Force 52 offered the solution: bring forward flying boats that could operate from the invasion fleet anchorage and conduct long range reconnaissance patrols in search of the enemy. The PBM-3Ds flown by VP-16 were robust enough to operate in the heavy swells off of Saipan and had a range more than double that of the carrier planes.

On 13 June, (likely in conjunction with the sailing of the First Mobile Fleet) Spruance "...asked for seaplane tender at Saipan at once, and requested that a patrol squadron be prepared for long range searches there when ordered" (Commander Forward Area Central Pacific. War Diary: 13 June 1944). The next day, "tenders *Pocomoke* [AV-9] and *Onslow* [AVP-48] were ordered to proceed immediately to Saipan" (Commander Forward Area Central Pacific. War Diary: 14 June 1944). Sighting reports from U.S. submarines continued to come in over the following days detailing the progress of the First Mobile Fleet. It became clear that *Pocomoke* and *Onslow* would not arrive quickly enough. Plans to bring forward a patrol squadron needed to be expedited.

At approximately 1130 on the morning of 16 June, *Ballard* received an order from Commander Task Force 52 Rear Admiral H.W. Hill (CTF 52) to send over an officer to "discuss seaplane operations and the installation of a seaplane base immediately" (*Ballard* War Diary: June 1944). After anchoring in berth A-13, *Ballard* obtained a bowser boat from USS *Alhena* (AKA-9) to assist with the impromptu operation. "Buoys were laid in the open sea approximately two and a half miles from the protective reef of Tanapag Harbor on the Saipan Shelf. Preparations were made to tend six (6) PBMs on an important mission to locate the Japanese Fleet" (USS *Ballard* War Diary: June 1944). The moorings used were likely Danforth anchors with yellow buoys as was later the standard used inside Tanapag Lagoon (Base Facilities Summary: Advance Bases Central Pacific Area 1945. 160). The forward-area seadrome now established was referred to as both "Saipan Seadrome" and "Garapan Roads" in the records, and henceforth will be referred to as "Garapan Roads."

With the island still mostly under Japanese control, *Ballard* laid out the seadrome in the only possible place: amongst the U.S. invasion fleet anchorage "approximately four miles from

the shore” (Patrol Squadron 16 War History) west of Susupe Point and invasion beach sectors Red and Green. The forward-area seadrome was an open-roadstead meaning that the area containing marker buoys, moorings, and runways were only roughly defined and unsheltered leaving the aircraft and tenders at the mercy of the seas and winds regardless of direction.

That night at Eniwetok, the aircrews of VP-16 first learned of the invasion of Saipan in a news broadcast that preceded a movie at Parry Island Open-Air Theater (Patrol Squadron Sixteen War History 1945). Word soon passed for all the officers of the squadron to meet at 2130 hours where they were ordered to depart for Saipan at 0600 the next morning as per instructions received in accordance with secret dispatch CTF 160935 (Patrol Squadron Sixteen War Diary: June 1944). Upon landing at 1500 on 17 June, the aircrews found heavier seas than they had ever operated in. Each PBM was subjected to “three to a half-dozen man-sized bounces” until finally coming to rest on the surface of the water (Patrol Squadron Sixteen War History:37). Heavy seas persisted throughout the entirety of operations at Garapan Roads making each takeoff and landing “...a series of violent, hull-straining bounces, which pounded rivets, bolts, instruments, and electrical gear” (Kammen 1959: 26). These conditions came to define the operational development of the Saipan Seadrome through trial and error forcing the introduction of new equipment, the modification of existing machines, and a complete overhaul in standard operating procedures (SOPs).

Refueling operations from the stern of *Ballard* began immediately, taking just over one hour per aircraft (*Ballard* War Diary: June 1944). An external nacelle fuel tank in the starboard bomb bay was also filled with an additional 390 gallons (Patrol Squadron 16 War History 1945). This was a standard procedure but usually (if not always) was accompanied by an armament of bombs, depth charges, or a torpedo in the port wing which counter-balanced the weight. It was

likely decided to forego arming the PBMs as less weight would increase their range. The absence of the counter-weight gave the aircraft a heavier starboard wing (Patrol Squadron Sixteen War History 1945).

Sea conditions deteriorated rapidly into the night with heavy chop and continually shifting winds with total overcast and intermittent showers reducing visibility to near zero. The pilots had to take off at night, for which they had never trained for. All these factors greatly increased the risk of “porpoising,” which is when an aircraft becomes off-balance during take-off or landing and begins to seesaw up and down nose to tail. The results of this can range from minor damage and personal injury to structural failure of the plane and the death(s) of aircrew. The dangers seemed an unnecessary risk to VP-16’s squadron commander who sent a message to Rear Admiral Hill attempting to cancel the mission. CTG 52 directly responded to the squadron commander aboard *Ballard* via the talk-between-ships (TBS) communications system explaining the importance of the mission and the necessity of getting the planes into the air (USS *Ballard* War Diary: June 1944).

Just after midnight on 18 June, the first Mariners began to take off. There were no buoys marking the runways and although blackout conditions over the U.S. invasion force were strictly enforced, *Ballard* and the destroyer USS *Phelps* (DD 360) attempted to light the area with searchlights (Patrol Squadron 16 War Diary: June 1944). The first pilots found that these lights actually blinded them and it was decided that the remaining take offs would be made on instruments alone. The Mariners had to taxi out approximately 4.5 miles from shore, turn toward the island, and ride the ocean swells from wavetop to wavetop while air speed was gained. Several pilots required multiple attempts before a successful take off was achieved. Upon gaining altitude, pilots had to bank sharply so as to avoid flying over the enemy-held island. All

the Mariners successfully launched into the air and flew their 700-mile long search sectors towards the Philippines (Patrol Squadron Sixteen War History 1945).

Shortly after dawn on 18 June, enemy air raid alarms rang out across the fleet and *Ballard* got underway to begin evasive maneuvering. In doing so, a bowser boat (presumably the one on loan from *Alhena*) broke loose, rolled under ship, and was struck by the port propeller, damaging the propeller, and sinking the bowser boat. At approximately the same time, Japanese shore batteries opened up on *Ballard* with several shots. One armor-piercing shell struck the rearming boat that was on the starboard aft deck. The shell passed straight through and into the water without exploding. Had it detonated, the resulting explosion's proximity to both *Ballard's* munitions magazine (forward) and the aviation gasoline storage (aft) would have likely been catastrophic. In an attempt to throw off the enemy gun's range, *Ballard* threw its rudder hard to port which resulted in the starboard propeller picking up the seaplane mooring buoy, though no damage was sustained to the propeller (USS *Ballard* War Diary: June 1944). The tenders and aircraft at Garapan Roads came under direct fire from enemy shore positions many more times, but none came so close to success as that which struck *Ballard*.

The four Mariners of VP-16 (one was unable to participate in the previous night's patrol) returned around noon with no contact reports. At approximately 1500, *Pocomoke* (AV-9) arrived at Saipan accompanied by *Onslow* (AVP-48), a *Barnegat* class tender. *Pocomoke*, being a larger AV of the converted C-3 merchant class, assumed seadrome control and took on the bulk of tending operations with *Onslow* and *Ballard* remaining on hand to assist (Kammen 1959:8). Captain C.O. Taff, USN, commander of Group One: Fleet Air Wing Two, was aboard *Pocomoke* and orchestrated all air operations (*Pocomoke* War Diary: June 1944).

Another VP-16 Mariner arrived that afternoon from Eniwetok bringing the total complement to six aircraft. Enemy planes were in the vicinity in the late afternoon. This delayed refueling and forced another night take off for the patrols of 18/19 June (Patrol Squadron Sixteen War History 1945: 41). Weather and seas remained about the same as they had been the night before, but planes all managed to get into the air without mishap. After midnight the PBM-3D piloted by Lieutenant (Lt.) H. F. Arle made radar contact with a large Japanese force near the very end of his patrol sector and immediately reported its position on both the primary and the secondary frequencies to ensure timely delivery of the message (Patrol Squadron 16 War History 1945: 42). Upon landing at 0800 the next morning (20 June) Lt. Arle found that his messages relaying the location of the Japanese fleet had never been received. The reason for this communication failure will likely never be known.

Regardless, at approximately 0830 that morning, the sighting report and position was sent out from the radio room of *Ballard*, but its value had diminished in the hours of delay as the Japanese fleet steamed hundreds of nautical miles on any given bearing in that time (Patrol Squadron Sixteen War History: 1945). Though undoubtedly useful, by the time Arle's contact report was received the carrier-based scouting groups of both forces were running into one another and the chance for a surprise attack against Ozawa's carriers had slipped away. The Battle of the Philippine Sea began that day. Unofficially, it is known as the "Great Marianas Turkey Shoot" as an ode to the huge number of Japanese planes shot down and the relative ease with which they were dispatched. The battle proved to be a pivotal point of the Second World War that effectively ended Japanese naval aviation as a serious threat to the allied advance (Tillman 2005).

The next night another PBM piloted by Lt. D.T. Felix, Jr. located what remained of the main body of the Japanese task force approximately 700 miles west of Saipan. Shadowing the enemy group, he reported its position and course for three solid hours (Patrol Squadron Sixteen War History 1945: 46-47). At this time U.S. carrier planes were returning from their missions in the dark and, having operated at the extremity of their range, were running low on fuel. Lt. Felix's information on the Japanese location and course meant that they were steaming away and not turning around for a night engagement. With the risk to the U.S. carriers significantly lowered, Rear Admiral Mark Mitscher ordered the ships' lights turned on thus creating a beacon that helped to guide his pilots to the fleet back thus saving a great number of lives (Tillman 2005).

Although the threat from the First Mobile Fleet had passed, U.S. forces at Saipan were still a prime Japanese target. Protecting the avenues of approach and withdrawal to the island was necessary for the duration of the battle and far beyond. "The closest American-held support base, Eniwetok, was 1,000 miles away. The Marshalls lay 1,500 miles to the east. Such a 'giant step' made the use of the flying boat requisite in handling the vital protective searches. Until airfields on Saipan were secure, no land planes were adequate in range to patrol the approaches to the Marianas" (Kammen 1959: 5-6). Hence, as the fighting raged ashore for the rest of June and into July, flight and tending operations continued at Garapan Roads. VP-16 was joined by VH-1, VP-216, VP-72, and VP-202 on 20 June, 23 June, 26 June, and 17 July, respectively. Between 17 June and 10 August 1944 alone, PBM-Mariners flew a total of 592 missions out of the open-roadstead and hundreds more thereafter (Kammen 1959: 78) (FIGURE 3.2).



FIGURE 3.2. Garapan Roads anchorage off of Saipan. Note the moored PBMs. Photo likely taken of the final location of Garapan Roads (Image courtesy of U.S. Army Signal Corps and Fold3).

3.2. Conditions, Difficulties, and Battlefield Modifications

The crews of other U.S. ships throughout the anchorage often watched the flying boats taking off as they violently bounced from swell to swell, seemingly on the verge of structural obliteration, until somehow lumbering into the air before banking sharply to avoid flying over the Japanese on the island. Given the proximity of the seadrome to the fighting, the sounds of gunshots and artillery were constant ambience for crews of both tenders and aircraft. U.S. progress ashore could be witnessed day-by-day (FIGURE 3.3).

In previous operations, Japanese infiltrators developed a reputation for swimming out into the ocean sabotage equipment and kill U.S. personnel. The numerous flying boats moored offshore were an excellent target for such activities. As a safeguard, “all aircraft at the buoys [were] manned by a taxi pilot, flight engineer, radioman, and two gunners who maintain[ed] continuous watch armed with a “tommy gun”” (Patrol Squadron Two Hundred Sixteen:



FIGURE 3.3. Panoramic view of the Garapan Roads Seadrome as seen from the deck of the USS *Chandeleur* compiled from photographs taken on 27 and 29 June 1944. Note the PBM Mariners. Vessels present in the photograph from left to right: *Mackinac* (AVP-13), *Ballard* (AVD-10), an unidentified vessel, *Mackinac* (AVP-13) again, and *Onslow* (AVP-48) (Photographs combined by author. Original images courtesy of the NARA RG 38).

Report of Saipan Operations: 2). Aircrews responsible for this duty typically rotated in and out with half the crew living on the plane and the other half berthed on a tender (Guttman 2004). Although the Mariner had a galley, a bunkroom with four bunks, and a head (toilet), the tropical heat and heavy seas caused violent seasickness and made adequate sleep difficult to obtain.

Ship and air crews aboard the tenders fared little better as the berthing accommodations aboard the tenders were inadequate for the number of men then aboard, which was always increasing. Coupled with numerous enemy air raids at night and the sweltering heat, this resulted in crews getting a dangerously low amount of sleep. During the first days especially, some went with “ten hours sleep in the last sixty, and five in the last forty” (Patrol Squadron Sixteen War History: 41). All the while they were still required to fly their assigned missions. Aircrews were intended to be rotated on and off flying duty every other day in order to assure proper rest, but the workload and inadequate personnel early in the operation made this impossible. Personnel had to perpetually operate on the verge of exhaustion (Kammen 1959).

The weather conditions at Garapan Roads were the crucible upon which everything was tested and no aspect, operational or material, continued without modification. Almost every procedure had to be refined to suit the transition from working on calm waters or solid ground, to operating from a mobile, unstable platform. Several battlefield modifications were forged out of the necessity to operate in this harsh environment.

Initially it was attempted to alleviate the strains on the crews and machines by moving the entire seadrome area closer to shore on 21 June and 1 July, thus placing the anchorages (for both tenders and aircraft) 5,300 and 3,250 yards from shore, respectively. The latter of these is believed to be the seadrome’s final location until the disbanding of Garapan Roads three months later (FIGURE 3.4). The immediate challenge was the danger to crew and machines when

refueling aircraft. Under normal conditions, refueling of aircraft was performed by bowser boats. Equipped with aviation gasoline tanks and pumps, a bowser boat would taxi alongside a moored seaplane, tie to it, and refuel the aircraft's tanks. *Barnegat* class bowser boats had a 1,500-gallon capacity, which required two trips per aircraft, but bowser boats of the larger tenders had a 3,000-gallon capacity and could refuel a Mariner in a single round trip (Patrol Squadron Two Hundred Sixteen: Report of Operations off of Saipan 1944: 4).

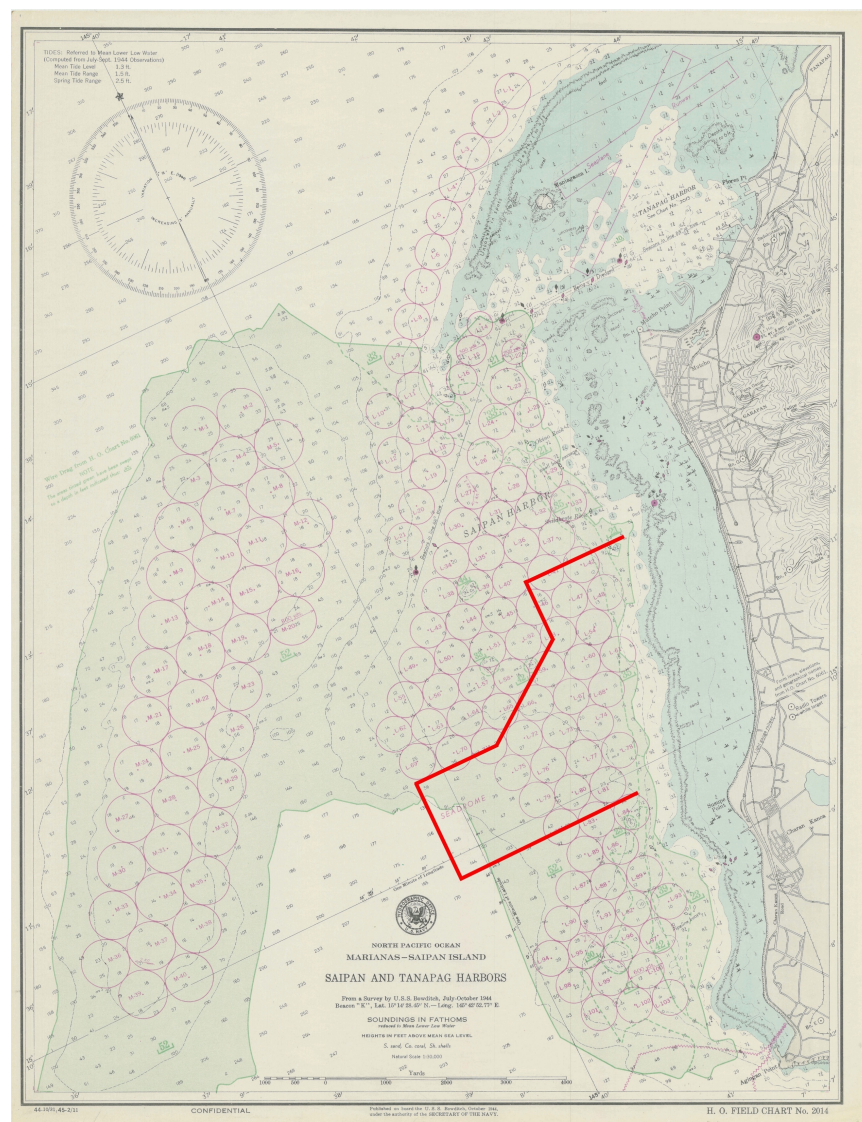


FIGURE 3.4. Mobile Hydrographic Office Chart 2014: Saipan and Tanapag Harbors. Note Tanapag Lagoon to the North East. Lines denoting seadrome area on the chart have been enhanced by author (Image courtesy of the NARA, Record Group 37).

This system was impractical and dangerous in an open-roadstead. For example, at 1130 on 19 June, *Pocomoke*'s aviation fuel barge #2 came alongside PBM #10 of VP-16 (Bureau Number 48173) for refueling. The approximately six-foot swells caused the propellers of the bowser to gouge a series of gashes between bulkhead #5 and frame #91. Although temporary damage control was carried out, the rough water eventually caused to the plane to sink at 1427, in approximately 17 fathoms of water (*Pocomoke* War Diary:19 June 1944).

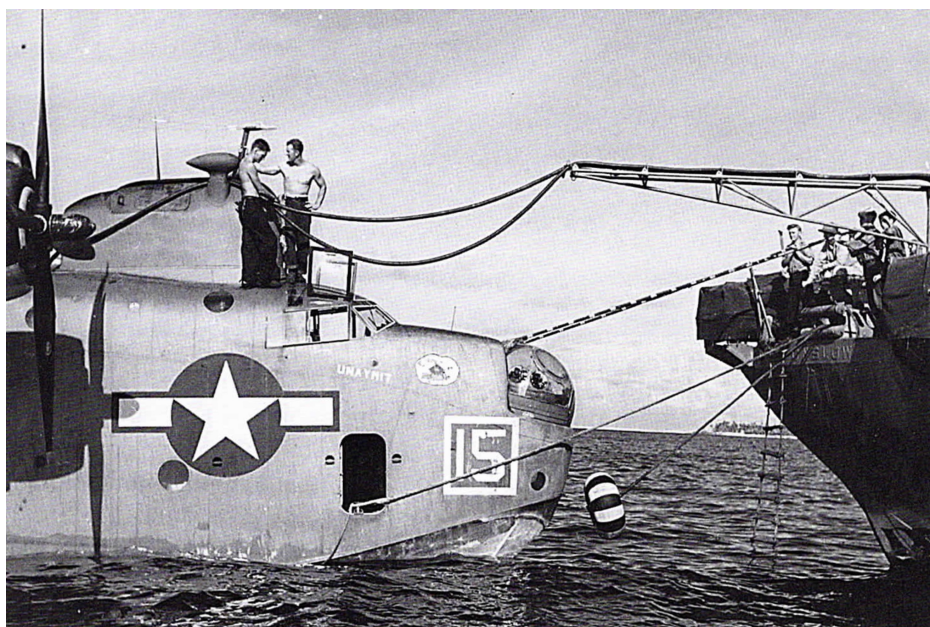


FIGURE 3.5. Original caption: "VPB-17 PBM-3D 'Unaymit' being refueled by the USS *Onslow* in December 1944." Note the fuel boom on the stern being used (Image courtesy of Ginter, Steve. "Naval Fighters Number Ninety-Seven: Martin PBM Mariner" page 149).

The better option was to refuel from the stern of an AVP or AVD tender via gas hoses, but this, too, was intended for calm waters as the aircraft were fairly close to the ship in order for crews to handle the heavy hoses. In rough water there was a high risk of the aircraft colliding with ship's stern and a distance of 50 to 60 ft had to be maintained to avoid this. Passing the heavy hoses over that distance was difficult and hazardous and so crew of *Onslow* were forced to improvise. A portable boom that cradled two gasoline hoses and an oil hose was engineered and mounted on the stern. The boom greatly diminished the dangers to crew and aircraft and

expedited the handling of planes by cutting refueling times nearly in half. It was used as a prototype for a similar boom that was installed on all AVPs soon after (FIGURE 3.5) (*Onslow War History* 1945).

At Garapan Roads, the Mariner proved that it was the ideal aircraft in the USN arsenal for forward seadrome operations. “Pilots with considerable flying experience in other types of patrol aircraft expressed an almost unanimous opinion that neither the PBV or the PB2V could have operated successfully under the conditions of very rough water” (Patrol Squadron Two Hundred Sixteen. Report of Operations off of Saipan 1944: 11). With Catalinas being too small to withstand the rough conditions and Coronados too difficult to maintain in large numbers, it is unlikely that forward-area seadromes would have been possible prior to the introduction of the Mariner, specifically the PBM-3D and PBM-5 variants. The Mariner “... was superior to the PBV in reliability, power, armament, self-sealing tanks, speed, and radar. The latter plane [PBV] rested too low in the way, and as consequence, took a fierce beating. The PB2V-5 was characterized by a tender bottom which withstood rough water poorly when the plane was well loaded” (Kammen 1959: 64).

Even so, the rugged PBM still developed issues. The constant battering of the seas on the aluminum hulls of the flying boats caused a myriad of problems. Electrical systems in bomb bays failed to operate at times due to an accumulation of moisture from ocean spray. Radio equipment and Identify Friend or Foe systems (IFFs) often malfunctioned because of the buffeting received on take offs, landings, and when moored (Kammen 1959: 26). Water leaks were common and screws and rivets had to be constantly retightened. The latter issue was likely the catalyst for a hull reinforcement change instituted by the Glen L. Martin Company for all Mariners in late 1944 (Carrier Aircraft Service Unit 48 War History 1945: 8-9).

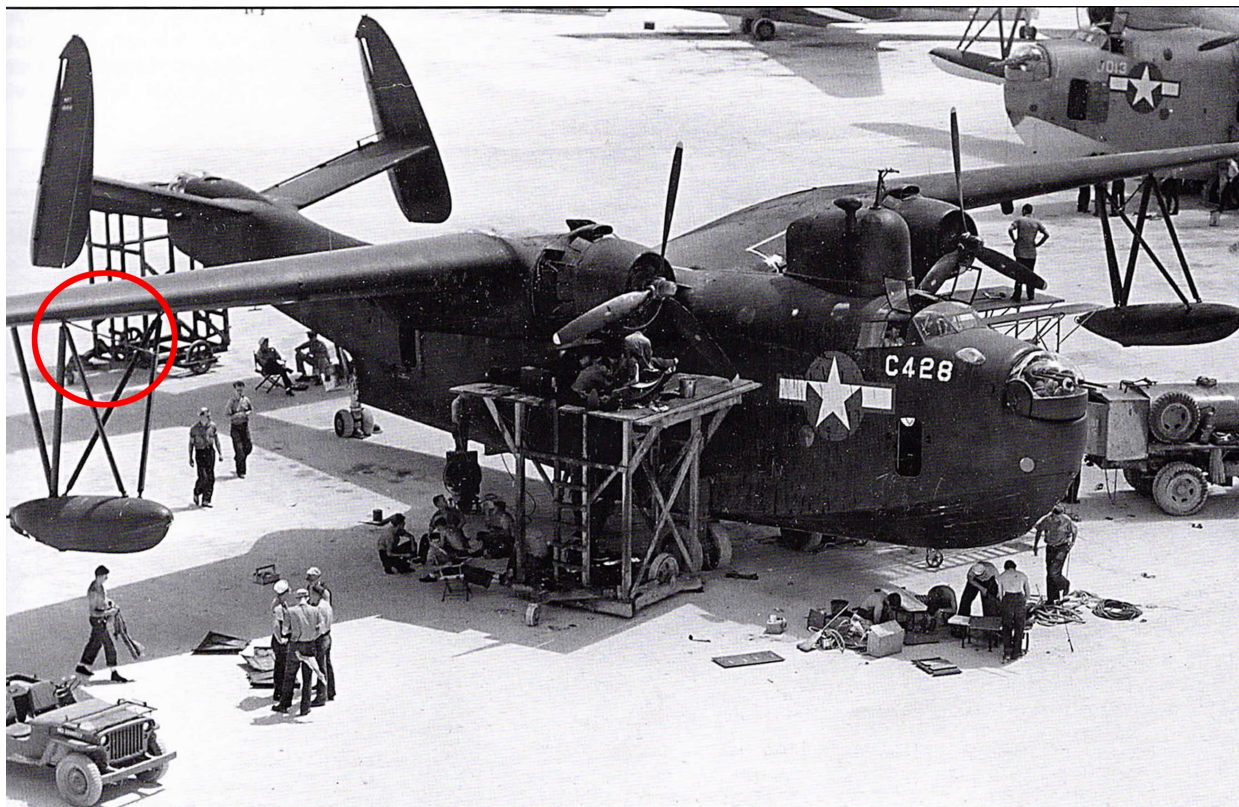


FIGURE 3.6. A PBM-5 of VPB-26 at Tanapag, Saipan, in 1945. Note what is believed to be the jury-strut. Visual emphasis added by author (Image courtesy of Ginter, Steve. "Naval Fighters Number Ninety-Seven: Martin PBM Mariner" Page 169).

The PBM's wing-floats had difficulty standing up to the severe shocks on take-offs and landings caused by the high swells. Two PBMs lost their floats and struts during the Saipan operation and nearly sank before they could be lifted from the water. "This led to a suggestion by Captains Weimer and Taff whereby a jury strut was incorporated on the wing-float assembly to strengthen them for a fore and after shock...[Following] this essential change, very few failures occurred" (Patrol Squadron Two Hundred Sixteen War History 1945: 41). It is believed that this was later incorporated into PBM production as jury struts are visible on many later Mariners (FIGURE 3.6).

The critical flaw with forward-area seadromes that was exposed at Garapan Roads was aircraft availability. The Mariner's engines required a total overhaul after 60 hours of flight time,

and had to be completely changed out after 120 hours of flight time (Kammen 1959: 25).

“Roughly two hours of ground work are required for each hour in the air. Where maintenance must be performed at moorings, planes are out of commission a greater percentage of the time due to the inability of the PATSU personnel to make the numerous repairs and adjustments” (*Chandeleur* Report of Operations 26 June 1944—17 July 1944: 4). “During the period of such swells, no tender can lower or hoist seaplanes or boats and several seaplanes will and did inevitably sustain structural damage necessitating extensive repairs. At such times, and in cases of full decks and damage to hulls from gunfire or coral...two AVs were not adequate to maintain the four squadrons involved” (*Yakutat* Supplemental Action Report, 17 July 1944—8 September 1944: 3).

AVPs and their PATSU units could only undertake basic maintenance and emergency repairs. The vessels were not capable of lifting the hefty Mariner from the water in order to perform extensive tasks such as engine swaps or to keep the aircraft from sinking due to hull damage. Although *Curtiss* class AV tenders were designed to have three Catalinas on deck, they could only handle two of the large Mariners and the C-3 conversion AVs had space for only one. This meant that the number of aircraft in operational condition was entirely dependent on how many AVs were present (Guttman 2004).

Without an adequate number of properly functioning planes, operations became less effective as missions were unable to be flown because “the number of sectors covered, day or night, is governed by the availability of seaplanes” (*Mackinac* War Diary, July 1944: 7). “During the first week of flying boat operations...at Saipan, a record of 59 percent [availability] was compiled. Taking the longer stretch at Saipan until 9 July, when the Japanese seaplane base became accessible, the availability decreased to 46 percent” (Kammen 1959: 65).

Furthermore, the tenders at Saipan needed to be available to participate in future operations. There were a limited number of tenders in the USN at the time and keeping them attached to one particular location was counterintuitive to the basic principle of forward-area seadromes: a semi-mobile seaplane base. The tenders, or at least most of them, had to be able to leave Saipan and seaplane operations had to be able to continue in their absence. Even as the war's front lines progressed ever farther away from Saipan, the island maintained a position of prominence in the larger strategic picture. Saipan became a staging area for tremendous amounts of war material and was a hub for shipping lanes and aerial traffic. Along with Guam and Tinian, Saipan would be the base from which B-29s belonging to the 21st Bomber Command that conducted a ferocious bombing campaign against mainland Japan. Air sea rescue operations were entirely necessary. Hence, diminishing or even closing down the seadrome at Saipan was not an option. On the contrary, it needed to be larger and more developed.

3.3. Establishing a Permanent Facility

The main seaplane base in the vicinity was originally intended to be at Guam once it was recaptured. After observing the excellent conditions of Tanapag Lagoon, this changed. "Recommendation was made to CinCPac [Commander in Chief Pacific Fleet, Admiral Nimitz] that in view of superior seaplane operating area and existing valuable shore facilities, the seaplane base scheduled for Guam be changed to Tanapag, Saipan, the site of the captured Japanese base... This was approved ultimately by CinCPac on the 17th" (Commander Forward Area, Central Pacific. War Diary: 5 August 1944). Efforts toward this end began long before Nimitz gave his approval. Tanapag Harbor (also referred to as Saipan Harbor in records), the island's deep-water port, needed to be made usable at the earliest possible date to facilitate the efficient unloading of various war materials. It was also imperative to move the seadrome inside

the sheltered waters of Tanapag Lagoon to establish a terrestrial facility from which to maintain the growing fleet of flying boats operating out of Saipan. As the harbor and the seadrome was sharing much of the same area, efforts toward both ends were made in conjunction with one another.

The Japanese seaplane base located at Flores Point in Tanapag Lagoon was heavily damaged with most of the buildings destroyed. A single concrete fuel bunker, several air raid shelters, the steel skeleton of a hanger, and two concrete seaplane ramps were all that remained standing. The grounds were strewn with debris. The lagoon itself was in a similar state with numerous sunken or half-sunken vessels and aircraft scattered around with floating debris clogging the waterways. Two *Diver* Class salvage vessels attached to Service Squadron Twelve, USS *Preserver* (AGS-8) and USS *Clamp* (AGS-33), began salvage operations inside Tanapag Lagoon on 9 July (Service Squadron Twelve War Diary: July 1944). Ships were assessed as to the extent of their damage and, if possible, were refloated and disposed of offshore. If it was not possible to refloat the vessel, divers would cut them up or blow apart piecemeal with the use of dynamite. The larger sections of material were then transported to predetermined disposal areas both within the lagoon and outside the reef. Other miscellaneous wreckage was cut down in place or scattered about on the bottom in such a way that it no longer posed a navigational hazard to flying boats or ships (Temporary Hydrographic Office Field Chart No. 2015, Tanapag Harbor: NARA Record Group 37).

Also on 9 July, the commanding officer of USS *Mackinac* (AVP-13), Commander G.R. Dyson, was "...assigned temporary duty as Officer-in-Charge, Seaplane Base, Tanapag Harbor, Saipan and commanded operations to place ramp in commission" (*Mackinac* War Diary, 5 July 1944: 5). That day a shore party began to clear debris from the ramps and hangers at Flores

Point, having to dispose of numerous enemy dead in the process. “On 10 July, a PBM-3D was beached [there]... Thereafter there was never a day when one or more Mariners were not parked ashore” (FIGURE 3.7) (Kammen 1959: 12). Commander Dyson had just become the first commanding officer of what eventually became United States Naval Air Base (NAB) 3245.

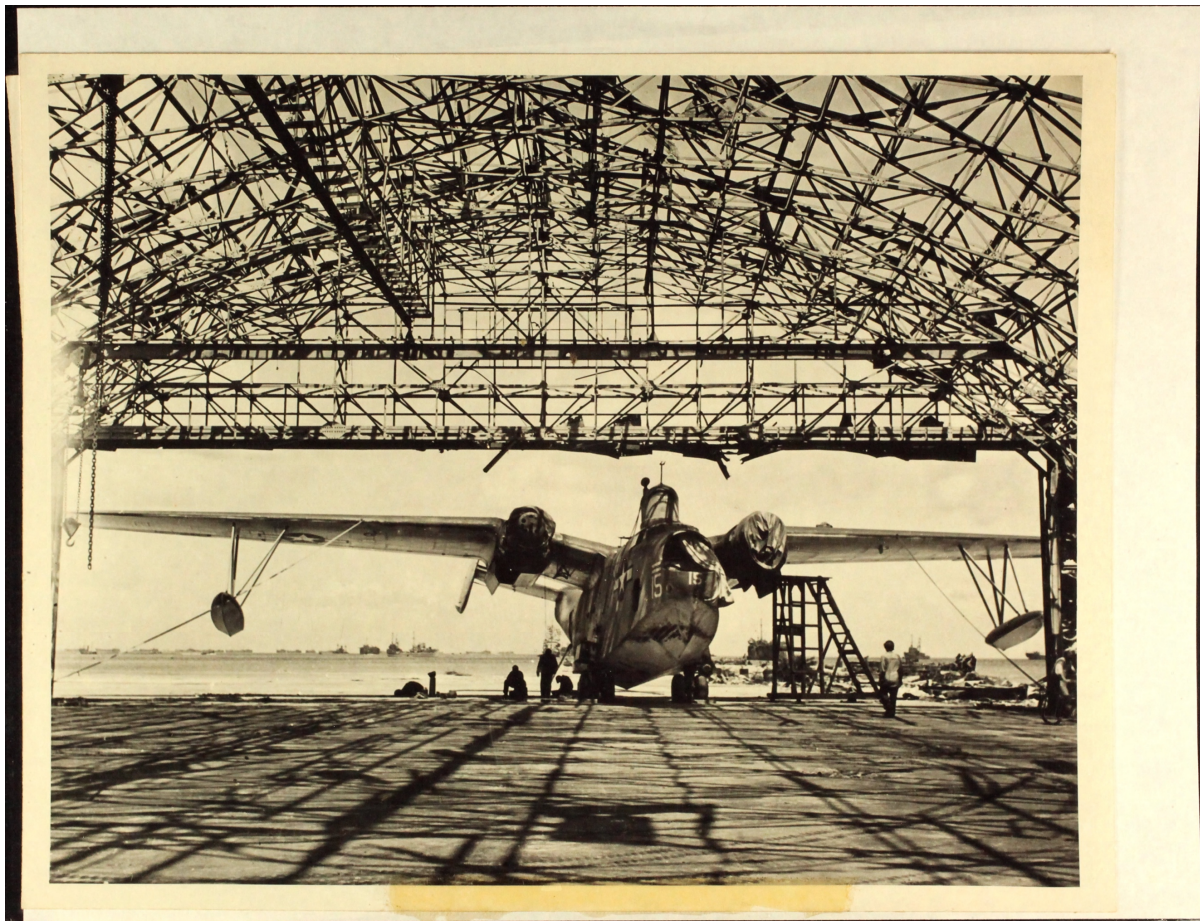


FIGURE 3.7. A PBM-3D undergoing maintenance in the destroyed hanger of the former Japanese seaplane base (Photo courtesy of U.S. Army Signal Corps and Fold3).

The seemingly simple endeavor of occupying a seaplane base on the recently captured island was not without risks. Several Japanese holdouts were killed in the vicinity of the hanger on the first day and “...one Japanese prisoner [was] captured and turned over to Marines” (*Mackinac War Diary*, 5 July 1944: 5). This was a continuing problem “...for each day Japanese dead had to be cleared from the area, and individuals or small groups of Japs [Japanese] were

engaged, killed, or captured” (USS *Mackinac* War History: 12). Guerilla fighting from bypassed Japanese soldiers and sailors was a serious issue on Saipan that persisted through the remainder of the war (Hallas 2019). Salvage crews continually flushed out Japanese holdouts still aboard disabled ships in the lagoon and were forced to kill if they refused surrender. Armed parties had to accompany anyone working in the harbor or ashore. Even with these precautions, Japanese guerillas did have some successes in the area around Tanapag Lagoon, succeeding first in blowing up an ammunition cache containing 84 tons of dynamite on 26 July and obliterating a pier in the process (Service Squadron Twelve: Report of Investigation of Dynamite Explosion, Tanapag Harbor, Saipan: 9 August 1944). They later destroyed and sank a Coronado at its mooring on 10 September 1944 (USS *Onslow* War History).

On 21 July, USS *Bowditch* (AGS-4), a large salvage vessel converted from a former passenger ship, arrived at Saipan. All salvage operations were conducted thereafter from *Bowditch*. Soundings were immediately begun both offshore and inside the lagoon. Wreck locations and types were recorded and wreckage disposal areas determined. Shore parties began to build triangulation stations, survey signals, hydrographic signals, ranges, and tide gauges on the main island as well as Mañagaha Island, located near the entrance of Tanapag Harbor (USS *Bowditch* War Diary: July 1944). Mobile Hydrographic Unit One aboard *Bowditch* published Temporary Hydrographic Office Charts 2014 and 2015 and distributed them throughout the fleet (USS *Bowditch* War Diary: July 1944) (FIGURE 3.8). These were the first accurate charts of Saipan’s waters available to U.S. forces and were used as the basic guidelines for the establishment of the seadrome and harbor area.

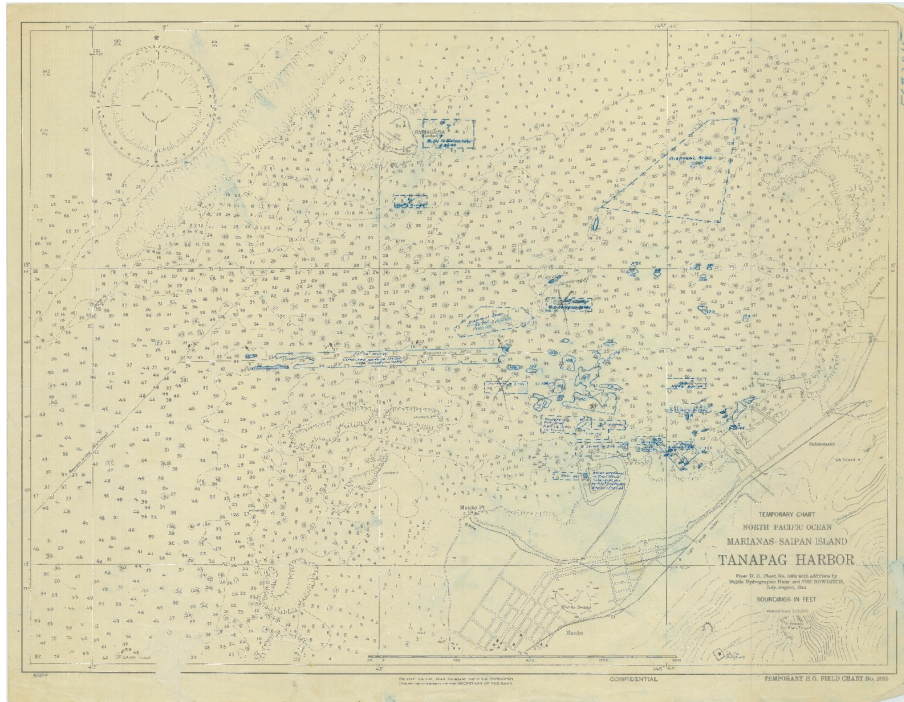


FIGURE 3.8. Hydrographic Office Field Chart 2015-A published aboard USS Bowditch. Note the hand-drawn locations of wrecks and disposal areas (Chart courtesy of the NARA, Record Group 37).

Sounding for the seaplane landing strips began on 27 July and wire dragging followed soon thereafter. Wire dragging is a simple, yet sound methodology of clearing for underwater obstructions. Essentially, a steel cable is dragged along the bottom via motor launches. Once an obstruction is snagged, a diver is sent down for an inspection. Natural obstructions, specifically coral heads, were frequently encountered with this method. Although beautiful, they were a navigational hazard (especially for the thin aluminum hull of a seaplane) and were disposed of with dynamite reducing them to piles of underwater rubble. If a human-made object was found, a salvage vessel would be called over to hoist the object out of the water, cut it apart, or a combination thereof (Commander Service Squadron Twelve War Diary: July-August 1944). Seaplane tenders are suspected to have participated in this to some degree as their powerful cranes were of use in the task of lifting objects off of the seafloor. Numerous Japanese seaplanes were located with this method as well as some U.S. aircraft lost during the battle. Some were

demolished in place (often via dynamite) while others were raised, inspected, and disposed of elsewhere. At times this was in the disposal areas, while other times the wreckage was dumped off the stern of the vessel so long as the minimum water depth was maintained in doing so (USS *Bowditch* War History 1945).

Similar methods were used when dealing with wrecked U.S. aircraft throughout the remainder of the war and beyond. Accidents at the active seaplane base were inevitable. This resulted in several sunken U.S. aircraft inside the seadrome area. Critical components, such the engines, armament, and classified equipment were salvaged immediately. If the aircraft posed a navigational hazard the wreck was either cut up and part or all of it removed to be dumped in a pre-designated area, or it was blown in place with the use of dynamite (Commander Service Squadron Twelve War Diary: July-August 1944).

Work continually progressed on the lagoon seadrome with a steady improvement of facilities. Flying boats first used the northeast-southwest runway (5/23) in Tanapag Lagoon on 3 August 1944, which was initially “marked with six (6) small navigational buoys” (*Bowditch* War Diary: August 1944). In total, three runways were surveyed and laid out. “The north runway was 1,000 feet wide and 9,000 feet long; the NE-SW runway was 1,000 feet wide and 12,000 feet long; and the south runway was 1,000 feet wide and 12,500 feet long. Of the three, the NE-SW runway was the one lit for night landings, being the best and most practical for day and night use” (Kammen 1959: 12). On 25 August, it was decided to abandon the southerly east-west runway as it interfered with the berthing of ships in the harbor (FIGURE 3.9) (Service Squadron Twelve War Diary: 25 August 1944).

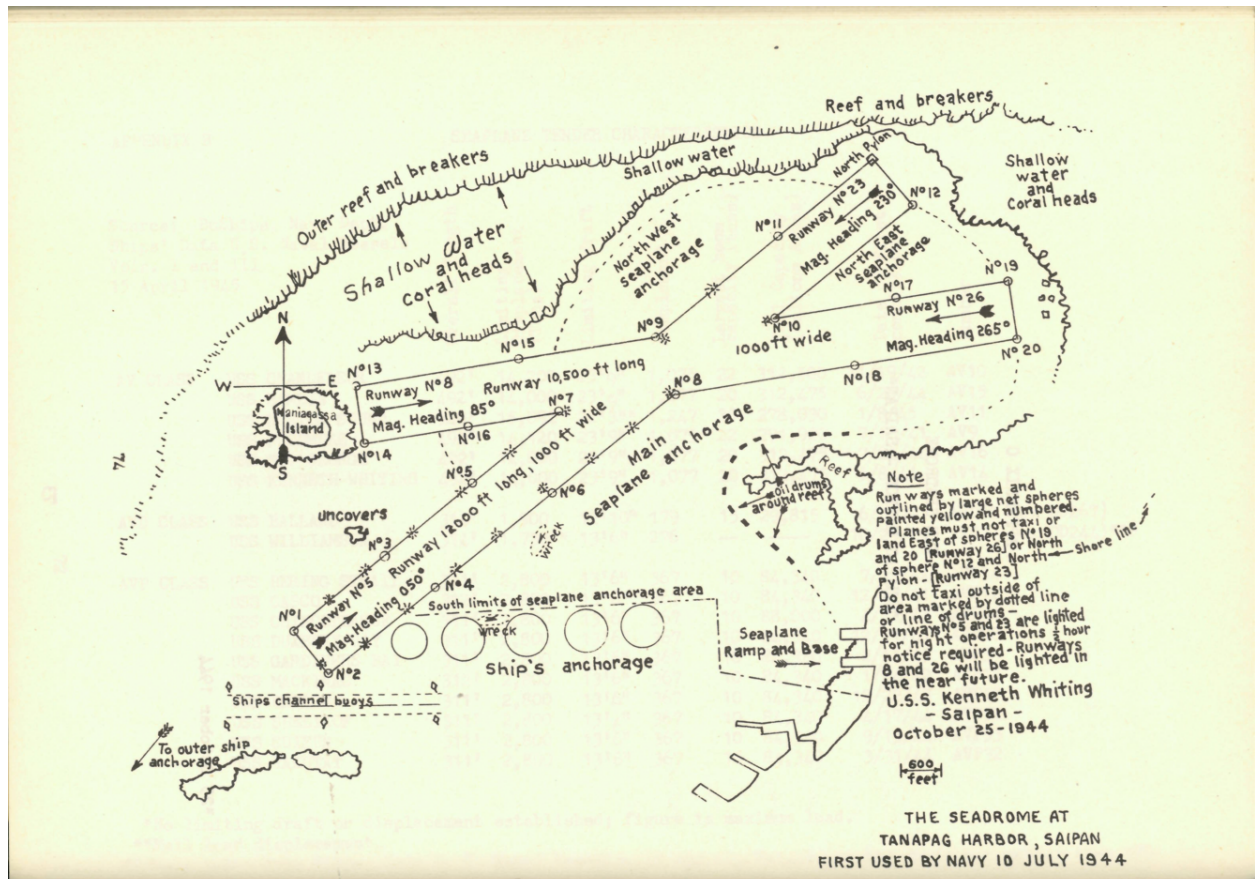


FIGURE 3.9. Patrol Squadron 216 map of Saipan Seadrome and facilities. Note the tender ship moorings just outside of the southern portion of the anchorage (Image courtesy of Kammen, Michael G., “Operational History of the Flying Boat: Open-Sea and Seadrome Aspects, Selected Campaigns-World War II.” Page 74).

“Runway naming convention labels runways as reciprocal pairs of compass headings, rounded to the nearest 10 then divided by 10. Thus, a runway with an east-west orientation ($90^{\circ}/270^{\circ}$) would be named 9-27. Runway 9 is the westerly end of the runway (facing due east), while runway 27 is the easterly end (facing due west) (NASA 2014)” (Pruitt 2015: 115). Runway 8-26 was on an approximate compass bearing of $80^{\circ}/260^{\circ}$ while runway 5-23 was on an approximate compass bearing of $50^{\circ}/230^{\circ}$.

Thereafter, there were essentially two separate seadromes at Saipan for a period of time: one at Garapan Roads and one in Tanapag Lagoon. A larger AV and the command aboard oversaw all operations and maintained local seadrome control of Garapan Roads, while a smaller

AVP oversaw the construction and establishment of a permanent facility and maintained local seadrome control of Tanapag Harbor. Ashore, temporary buildings and tents were erected along with maintenance facilities, some making use of the remaining Japanese concrete structures. “When it became apparent that the seaplane base would become permanent, additional men were ordered, additional buildings started (including mess hall and galley), and a permanent camp set up” (*Yakutat* Supplemental Action Report, 17 July 1944—8 September 1944: 2). A wooden control tower constructed on top of the former Japanese fuel bunker became the most prominent feature of the base (FIGURE 3.10).

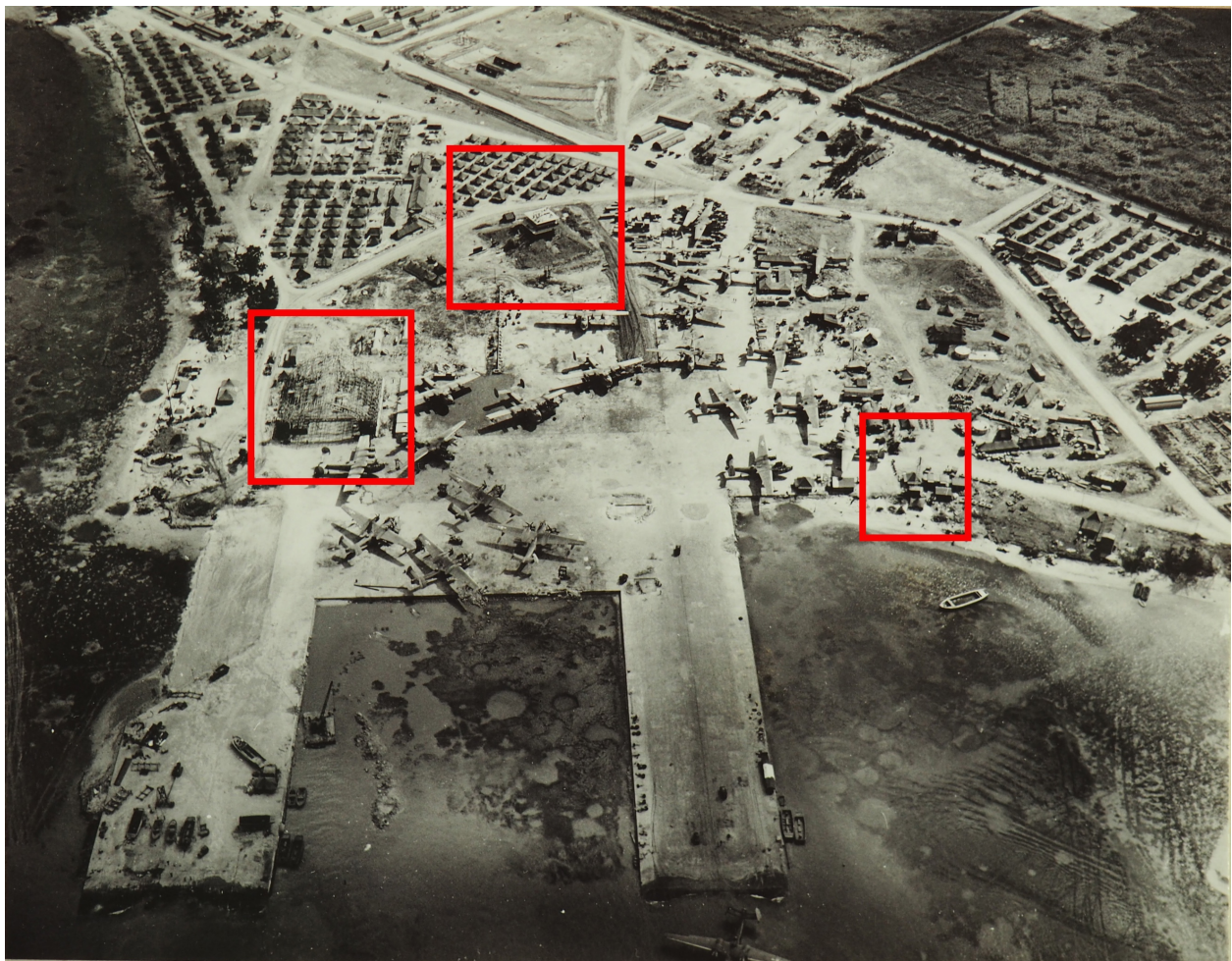


FIGURE 3.10. Aerial view of the terrestrial facilities at NAB Saipan in November 1944. Note the remains of Japanese hangar (left), the control tower (center) and the front range tower (right) (Image courtesy of CNMI HPO. Edited by author for emphasis).

On 9 September, crews completed marking the runways with “20 large yellow spherical (net type buoys)” (USS *Bowditch* War Diary: September 1944). On 10 September, Group One, Fleet Air Wing Two was officially dissolved and all seaplane and tending operations (including the current and future shore facilities) at Saipan were absorbed into Fleet Air Wing One (Group One, Fleet Air Wing Two War Diary, 1 August—10 September 1944: 9-10). Two days later, with the Tanapag Harbor Seadrome and accompanying shore facilities adequate, most of the tenders and squadrons that had operated at Garapan Roads began sailing or flying toward the war’s next forward-area seadrome to be established at Kossol Passage in the Palau Islands. The newly constructed terrestrial facilities at the Flores Point Seaplane Base and the Tanapag Lagoon Seadrome were officially commissioned as United States Naval Air Base 3245: Saipan, Marianas Islands on 1 October 1944.

On 7 October, “all seaplanes operating in the seadrome area, Garapan Anchorage [Garapan Roads], were transferred to the seadrome, Tanapag Harbor and mooring buoys removed from Garapan Anchorage” (*Coos Bay* War Diary, October 1944: 1). On 10 October, USS *Kenneth Whiting* (AV-14), moored inside of Tanapag Harbor, becoming the first large tender to do so, and the next day “...assumed operational control of the seadrome in Tanapag Harbor” (*Coos Bay* War Diary: October 1944). Met with little to no fanfare, this was end of the Garapan Roads Seadrome, the first true forward-area seadrome. From then on, seaplane operations at Saipan were conducted entirely from NAB 3245.

NAB 3245 continued to grow thereafter. A terrestrial voice-radio air traffic control tower known as “Havana Tower” was built atop the former Japanese fuel bunker. As of May 1945, 20 rearming boats, 12 personnel boats, and 7 bowser boats were present. Some 65 seaplane moorings were eventually laid sporting 500lb Danforth anchors. Between the moorings and the

Flores Point Seaplane Base, it was estimated that 155 aircraft could use NAB 3245 (Base Facilities Summary: Advance Bases Central Pacific Area 1945. 160). The seaplane base operated through the remainder of the war as one of the main rear-area supply and repair facilities in addition to providing invaluable patrol and air-sea rescue duties. Ultimately the facility was closed in 1949 (DeFant 2012: 11).

3.4. Forward-Area Seadromes Through the Remainder of the Pacific War

The Kossol Passage Seadrome was established on 16 September 1944 in support of the invasion of Peleliu (another facet of Operation FORAGER) by Garapan Roads veteran tenders *Pocomoke*, *Chandeleur*, *Onslow*, *Mackinac*, and *Yakutat*. The next day, 41 PBM-3D Mariners and five PB2Y Coronados from squadrons VP-16, VP-202, VP-216, and VH-1 arrived and were moored by 1400. By 1800, four aircraft were already conducting aerial patrols (Fleet Air Wing One: Report of Air Operations in the Palau Area 9 September to 15 October 1944). This was a far cry from the single tender and five PBM Mariners that had initiated the Garapan Roads seadrome.

It was only the second operation of its kind in just three months. Unlike at Garapan Roads, however, the enterprise was no longer thrown together piecemeal forcing units unfamiliar with one another to operate together in an unaccustomed manner and in an entirely new environment. Instead, PATSUs and tenders formed veteran units with experience in the particular task required of them working together and moving en masse to operate in conjunction with amphibious operations. The sea conditions at Kossol Passage were considerably improved over those at Saipan. The main threat now came from 400 Japanese sea mines that were planted throughout the proposed seaplane anchorage (Fleet Air Wing One Action Report, 10

September—15 October 1944). These had to be cleared by minesweepers before the first moorings could be laid. Even after minesweeping was completed and operations began, mines were a reoccurring danger that were often dealt with by simply shooting them with machine guns or rifles either causing them to detonate or to sink (Kammen 1959).

When the waters were deemed safe (or at least safe enough) the seadrome and anchorage was laid out “within 14,000 yards of the northern tip of the Japanese stronghold of Babelthuap” (Fleet Air Wing One Action Report, 10 September—15 October 1944: 3). Though bypassed, the island of Babelthuap contained a garrison of some 20,000 Japanese troops (USS *Birmingham* Cruise Book. 76). Raids by carrier-based aircraft effectively neutralized the island by destroying all of its offensive capability and a great deal of its defensive positions. Aircraft commonly used Babelthuap for gun testing and training missions (essentially live-fire exercises) with very little risk of effective resistance. Servicemen in the seadrome often watched these exercises as entertainment from the decks of the tenders. Although the island no longer posed a serious threat, the fact that a seadrome could be established in such close proximity to a large, permanent enemy garrison further cemented the versatility of forward-area seadrome operations. From the experiences gained at both Saipan and Palau, it was proven that tender-seaplane units could move into an area on D-Day and immediately undertake reliable mail-runs, search and rescue operations, hospital transportation, and 24-hour anti-submarine patrols (Fleet Air Wing One Action Report, 10 September—15 October 1944: 3). Thereafter, forward-area seadromes were incorporated into most major amphibious operations through the remainder of the war. The two most notable seadromes during this period were at Iwo Jima (part of the Bonin Islands) and Kerama Retto, Okinawa.

Saipan-based B-29s began their bombing campaign against the Japanese homeland in November 1944. At the time, there was no fighter capable of covering the same distance and so the bombers had to conduct their missions without escort. The Japanese defenders on Iwo Jima, an island located 660 nautical miles from Tokyo and 625 from Saipan, were able to give ample warning of approaching U.S. bombers and to send up intercepting fighters. The capture of Iwo Jima neutralized this threat and provided a base from which U.S. fighters could escort B-29s to and from their targets. Furthermore, damaged aircraft unable make it home had a friendly airfield for emergency landings. The island's seizure was thus deemed necessary (Hammel 2009).

D-Day for Operation DETACHMENT, the capture of Iwo Jima, occurred on 19 February 1945. USS *Williamson* (AVD-2), the sister ship of *Ballard*, arrived the same day. *Hamlin* (AV-15) and *Chincoteague* (AVP-24) joined on the day after D-Day (D+1). It was initially intended to establish the seadrome on D-Day or D+1, but heavy sea conditions and effective enemy artillery fire from the beach prevented this until 24 February following the capture of Mount Suribachi, the island's most prominent peak. Even with the moorings laid, extremely poor weather conditions and the congestion of the seaplane area prevented patrol operations and the stationing of squadrons there for four additional days (Kammen 1959). Nevertheless, flying boats did come in and out of Iwo Jima throughout this time ferrying high-ranking officials, war correspondents, and priority-mail mostly to Saipan. On D+1, a PBM-5 of VPB-26 made a round trip to Iwo Jima. Piloted by Lt. Cornish, the aircraft "...made an exceptional take off that day in very rough seas, under adverse conditions – a six second JATO take off" (Patrol Bombing Squadron Twenty Six War History: 5). This is among the first uses of JATO tanks in the Pacific theater and the first in such conditions. The introduction of the JATO system greatly diminished the problems that plagued flying boats during take offs by alleviating the hydrodynamic and structural problems

associated with rough water. JATO tanks became standard equipment at the Kerama Retto Seadrome at Okinawa. Notably, on 24 February Lt. Cornish's PBM made another round trip to and from Iwo Jima, this time flying out the film containing the famous Mount Suribachi flag raising photograph as part of its cargo (Hoffman 2004: 55).

VPB-19 finally arrived to be stationed at Iwo Jima on 27 February and were later joined by VH-2. Although the weather conditions were somewhat alleviated, the major issue was navigational hazards. Half sunken barges, rafts, timbers, ammunition cases, oil drums, gasoline cans, blood plasma crates, and corpses all littered the seadrome area. This forced the flying boats to operate in distances up to ten miles from shore leaving them, once again, completely at the mercy of the elements. As before, their mission was to conduct vital search and reconnaissance operations. Fortunately, airfields on the island were quickly captured and placed into commission and by 6 March, the seadrome began to be disbanded, replaced by terrestrial PB4Ys. Between 24 February and 8 March, 52 landings and 51 take offs were conducted from the Iwo Jima Seadrome (Kammen 1959).

By March 1945, the allies were poised to invade mainland Japan. Before that could occur, a much closer land-base was needed to support fighter operations for close air support, huge airfields and storage areas for more bombers, and harbor facilities sufficient enough to support an invasion force. Okinawa fit these prerequisites and Kerama Retto, a small group of islands some 15 nautical miles southwest of Okinawa was chosen for the establishment of the (now standard) seadrome. Loosely surrounded by three islands, the Kerama Retto Seadrome was much more sheltered from the elements than those at Saipan and Iwo Jima. "Except for occasional coral sand beaches, there are precipitous rock cliffs from the coastline. Thus it was virtually impossible to beach aircraft in order to facilitate repairs" (Kammen 1959: 43).

Kerama Retto was occupied by U.S. forces on 25-26 March 1945. The large tenders *Hamlin* (AV-15), *St. George* (AV-16), and *Chandeleur* accompanied by smaller tenders *Bering Strait* (AVP-34), *Onslow*, *Shelikof*, and *Yakutat* arrived on 28 March and immediately began seadrome establishment four days prior to the invasion of Okinawa (Operation ICEBERG). The next day, 30 PBMs began operating out of the Kerama Retto Seadrome. By mid-June, numbers at Kerama Retto had swelled to 14 tenders (five AVs and nine AVPs) tending approximately 95 seaplanes (Kammen 1959). Seadrome establishment and operations were streamlined with speed, efficiency, and adequate floating facilities.

The semi-sheltered seadrome allowed for the majority of aircraft servicing to be efficiently carried out on the water and the five AVs present meant that the more in-depth maintenance issues could be handled in timely manner. Thus, aircraft availability did not suffer. Through this experience, it was finally determined that three AVPs and one AV were the ideal combination to tend a 15-plane squadron of Mariners. Air operations out of Kerama Retto fanned out to Formosa, the east coast of China, Korea, across Tsushima Straits, and both coasts of Kyushu. In lieu of the elements, kamikaze attacks on several occasions proved to be the greatest operational threat at Kerama Retto, but these ultimately proved unsuccessful in halting operations. On 14 July, the force at Kerama Retto shifted to the more protected seadrome at Chimu Wan on the east coast of Okinawa (Kammen 1959).

3.5. *Legacy*

In terms of legacy, it is difficult to determine the level of impact that the Saipan seadromes had on the Pacific War. The Tanapag Seadrome (and the larger NAB Saipan which it was a part of) is historically significant as a study of post-battle cleanup and U.S. Naval facility

development. This type of operation occurred numerous times throughout the Pacific Theater immediately following most territorial gains by the U.S. To the author's knowledge, however, Saipan is the only location where extensive salvage and construction was occurring in conjunction with an active, large-scale seaplane operation.

Garapan Roads Seadrome and the operations conducted there fell short of having a greater prominence in the annals of the conflict because of a fluke: Lt. Arle's missed radio message. The Battle of the Philippine Sea may have played out differently had the transmission detailing the location of the First Mobile Fleet been received and the squadrons flying out of the impromptu seaplane facility at Saipan would have been the catalyst for it. But as is typical of the confusion of war, this did not occur and therefore Garapan Roads has been largely overshadowed in the historical studies of the Pacific Theater.

The legacy of Garapan Roads is that it was the first of a new type of operation and the foundations of all subsequent forward-area seadromes were created there. Garapan Roads was successful in this regard because of the prowess and ingenuity of the personnel stationed there. Never before had a seaplane operation of that magnitude been attempted under such conditions so close to the front lines (quite literally only a few miles from the enemy). As examples, the aircrews flying from the open roadstead took great personal risks with every takeoff and landing as a result of the heavy seas, the tender and PATSU crews were forced to adapt by improvising new methods and equipment through battlefield modification, and the aircraft were required to operate beyond what they were originally designed for.

One of the basic and most important principles of military strategy is protecting one's avenues of approach and withdrawal. The Garapan Roads operation illustrated that forward-area seadromes were well-suited to fulfill this vital role and as such they were incorporated into many

major strategic operations for the remainder of the war. Forward-area seadromes were only employed for just over a year before Japan surrendered. At the time that they were employed, Japan's offensive capabilities were far depleted from what they had been at the start of WWII, therefore forward-area seadrome operations did not have the value to allied operations as they would have in 1942, for example. The sighting of the Japanese super-battleship *Yamato* as it steamed toward the U.S. invasion fleet off of Okinawa was possibly the greatest offensive contribution of forward-area seadromes. The ship was later set-upon and sunk by carrier-based aircraft thus averting possible disaster (USS *Chandeleur* War History, 1945: 20).

Nonetheless, forward-area seadromes excelled in the role of dumbo operations and this may be the greatest contribution of forward-area seadromes to WWII. Kerama Retto alone was ideally positioned not only for the rescue of B-29 crews, but also of downed aircrews participating in the fighting around Okinawa. In the last six months of the war, air-sea rescues reached their apex of success. In March, April, and May, for example, 70 percent of U.S. aircrews forced down into the open seas were rescued (Kammen 1959).

Ultimately, forward-area seadromes became victims of technological advancement. The end of Second World War saw the introduction of nuclear weapons, jet propulsion, missiles, helicopters and numerous other technological leaps in military technology. The flying boat simply became outdated. Furthermore, with victory the U.S. obtained innumerable land bases all over the globe from which terrestrial aircraft could operate from. There was no longer a need to establish floating facilities when airfields were so readily available. Although flying boats and tenders both continued to be employed by the U.S. military into the Vietnam War, forward-area seadromes became obsolete.

Chapter 4 Results

4.1. Terrestrial Surveys



FIGURE 4.1. Aerial photograph taken 10 November 1944 of Flores Point Seaplane Base. Notice the tents, Quonset huts, control tower, hangar, and the numerous PBMs and PB2Ys undergoing maintenance (Photograph courtesy of CNMI HPO).

After securing Saipan, U.S. forces reclaimed and reused as much as possible on the island. This is especially true in terms of the robust concrete facilities initially constructed by the Japanese at the Flores Point Seaplane Base. Contemporary photographs indicate that structures on the site not totally destroyed during the battle, specifically the fuel and bomb storage bunkers, air raid shelters, the steel framework of the large aircraft hangar on site and the seaplane ramps themselves, were left intact (FIGURE 4.1; FIGURE 4.2). With the exception of the steel framework of the large hangar (FIGURE 4.3), which was removed sometime during the post-battle period, most of the Japanese concrete structures are still present today (DeFant 2012).

Most of the U.S.-built facilities in the immediate vicinity of the Flores Point Seaplane Base were semi-temporary structures of canvas and wood augmented by a great many Quonset huts



FIGURE 4.2. Enhanced aerial photo of Flores Point Seaplane Base. On the left, an air raid shelter being used for what is theorized to be part of the kitchen/mess hall. On the right, a concrete air raid shelter being used for radio broadcasting (note the radio tower directly adjacent to the structure). A recent enlargement of the seaplane ramp by U.S. forces is clearly visible in the photo as well (Photographs courtesy of CNMI HPO).



FIGURE 4.3. Photographs of former Japanese Hanger being repurposed for maintenance and storage by U.S. forces. Note the U.S. aircraft wing in the left photograph and the flying boat beaching gears and stored propellers in the right photograph (Photographs courtesy of CNMI HPO).

4.1.1. Mutcho Point and the Former Japanese Lighthouse

Terrestrial surveys were aimed at locating and identifying the Tanapag seadrome and harbor navigational beacons and ranges, as well as landmarks used by the USN survey crews as control points (or triangulation stations) for the placement of runways, moorings, and other installations. These began on 8 July 1919 with a shoreline survey of Mutcho Point aimed at locating Beacon H. The survey revealed that the shoreline in this area has changed extensively since the Second World War, and thus Beacon H was unable to be located (FIGURE 4.4).

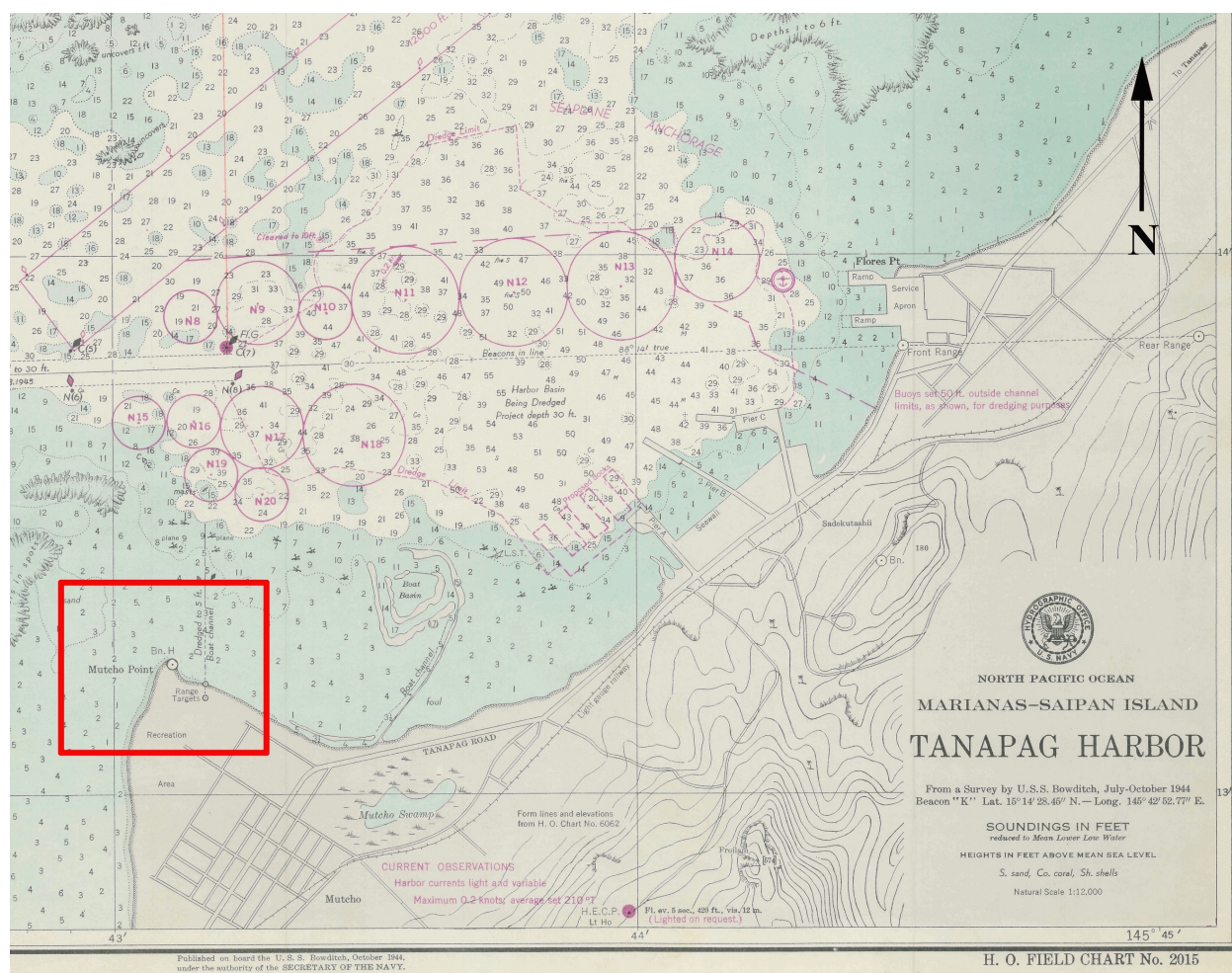


FIGURE 4.4. Red square emphasizing location of Beacon H. It is theorized by the author that this installation may have been destroyed by shoreline erosion (Image has been altered by author to emphasize area of focus. Chart courtesy of NARA, Record Group 37).

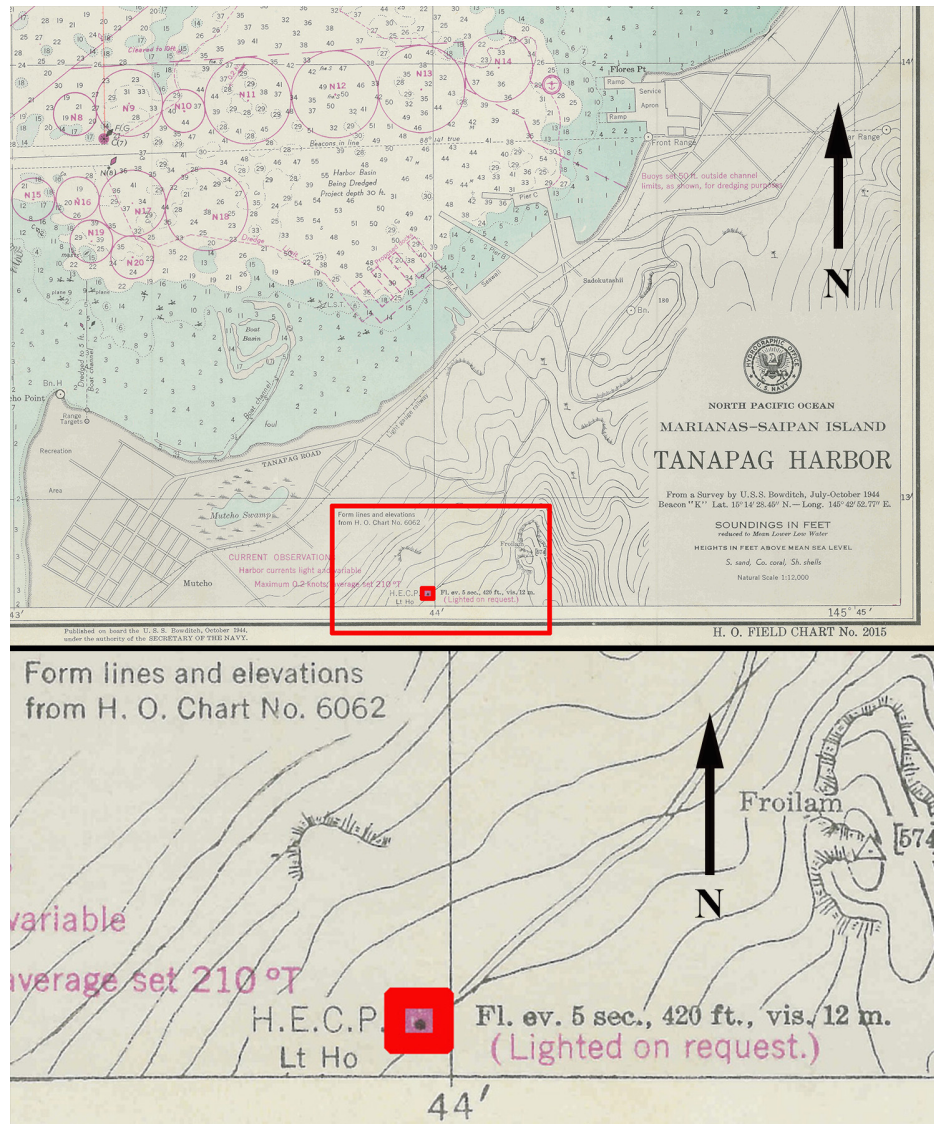


FIGURE 4.5. Location of “Old Japanese Light House” as denoted on H.O. Field Chart 2015. Note the location of the lighthouse in correlation with the harbor, Flores Point Seaplane Base, and seadrome. The elevated position makes it an ideal control point. Both images enhanced by author to emphasize location and chart labeling (Images enhanced to by author to emphasize detail. Chart courtesy of NARA, Record Group 37).

Surveys performed on 9 July 2019 began with a visit to the former Japanese Lighthouse, today known locally as the “Old Japanese Lighthouse,” located at UTM 55P 0363762E 1682156N.

Built on a prominent hill to the southeast of the small boat basin and directly to the south of the harbor docks, the lighthouse overlooks Tanapag Lagoon. As one of the few widely visible, permanent structures left standing after the battle it was often used as a control point for

triangulation by U.S. survey crews when constructing the harbor and seadrome (FIGURE 4.5; FIGURE 4.6). The structure appears to be abandoned and has fallen into disrepair. In numerous areas the concrete is beginning to disintegrate and the metal components, such as railings and stairs, are extremely corroded. Access to the interior was not attempted due to safety concerns.



FIGURE 4.6. "Old Japanese Lighthouse". Photo taken looking approximately north (Photo taken by author on 9 July 2019).

4.1.2. Flores Point Seaplane Base Survey

Also on 9 July, the Flores Point Seaplane Base was surveyed as thoroughly as safe access permitted. The seaplane base had previously been surveyed in 1987 by J. Guerrero (and designated as HPO site number SP-1-15-7-0106 (Guerrero 1987). A smaller portion of the seaplane base was later resurveyed in 2011 by David DeFant as an archaeological remediation

project (DeFant 2012). Among the features identified was the former Japanese fuel bunker turned U.S. seaplane base control tower, known as “Havana Tower” by U.S. forces (Base Facilities Summary: Advance Bases Central Pacific Area 1945. 160), located at UTM 55P 0364790E 1684209N (FIGURE 4.7; FIGURE 4.8; FIGURE 4.9). Although this site had been previously surveyed, it was decided to reexamine it with the specific focus of identifying evidence of its use by U.S. forces. The building is owned by the nearby Commonwealth Utilities Corporation and is used for storage. Access to the interior was granted, but due to the large amount of material inside no evidence of use by U.S. forces was observed. As the earthen revetments originally surrounding the exterior were removed sometime between the 1987 and 2011 surveys, access the roof to the building was not possible. Therefore, the presence or absence of cultural material related to the US control tower built there could not be confirmed (FIGURE 4.10).



FIGURE 4.7. ArcGIS Overlay on H.O. Chart 2015 (left) and 1945 aerial photography (right) of Havana Tower atop former Japanese fuel bunker at Flores Point. Note the black and red GPS point in both images (Image and chart have been enhanced to emphasize control tower. Photograph courtesy of CNMI HPO. Chart courtesy of NARA Record Group 37).



FIGURE 4.8. Aerial photograph of Havana Tower 10 November 1944. Original photograph enhanced by author to emphasize tower (Photograph has been enhanced to emphasize control tower. Photograph courtesy of CNMI HPO).



FIGURE 4.9. Havana Tower under construction on roof of former Japanese fuel storage bunker sometime in late 1944 (Image courtesy of DeFant 2012 page 16).



FIGURE 4.10. The former US control tower “Havana Tower” as of July 2019. Note the absence of earth ramparts and structure on the roof. Photo taken looking approximately west (Photograph taken by author on 28 July 2019).

The first of the Japanese facilities around Tanapag Lagoon to be reused by the USN were the navigational ranges. In the era before precision navigational technology, ranges were the universal system used to mark shipping channels for safely entering and exiting harbors. Ranges are constructed in pairs with a front (lower) and rear (higher) tower. The pilot of a ship positions their vessel so that the visual aids on the towers align thus ensuring that the linear path between the ranges and the vessel are safely navigable. Many of these have the ability to be lighted for nighttime use. Prior to the publishing of H.O. Field Charts 2014 and 2015 aboard *Bowditch* in July 1944, U.S. forces had no accurate charts of the waters around Saipan (Commander Forward Area, Central Pacific. War Diary: 5 August 1944). Therefore, the ranges would have been the only visual navigational aid available for vessels of substantial size and draft entering the and exiting the lagoon (FIGURE 4.11). Although Tanapag Channel was improved by post-battle dredging and wreck removal, the general location remained unchanged. Hence, photographic evidence indicates that the Japanese-made ranges were left in place and repaired and/or

improved as necessary. As this system is still in use at Saipan, it can be assumed that these ranges have continually been updated since 1944 through today.

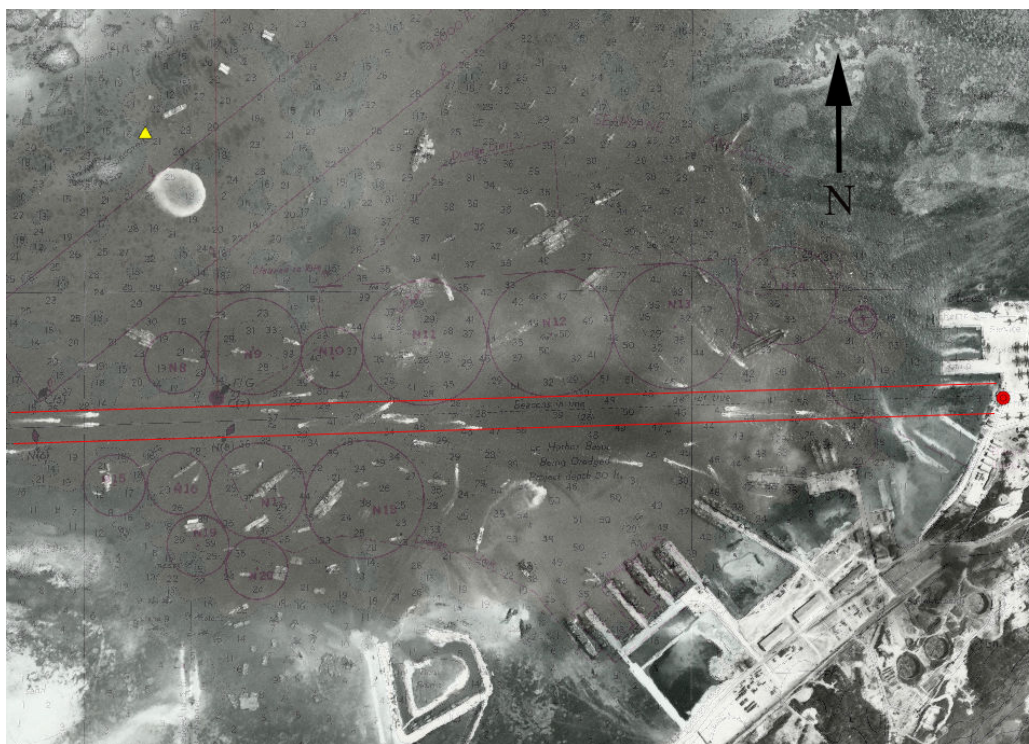


FIGURE 4.11. ArcGIS overlay of a 1945 aerial photograph of Tanapag Harbor and H.O. Chart 2015. The front range is in red and the red horizontal lines have been added by the author to emphasize travel area. Notice the boat traffic traveling in line with the range (Photograph courtesy of CNMI HPO. Chart courtesy of NARA, Record Group 37).

GPS coordinates of the approximate location of the front range located to the immediate south of the seaplane ramps at Flores Point were obtained through ArcGIS overlay and used to locate the remains of that site. It was determined that a modern range tower located approximately at UTM 55P 0364792E 1684075N was built directly on top of the original tower (FIGURE 4.12; FIGURE 4.13). The GPS coordinates of the modern tower are only approximate as the presence of thick vegetation and modern debris did not allow for closer access (FIGURE 4.14). The modern rear range was observed from a distance, but access to the facility could not be obtained (FIGURE 4.15). An ArcGIS overlay determined that this range was also in the approximate location of the wartime rear range.

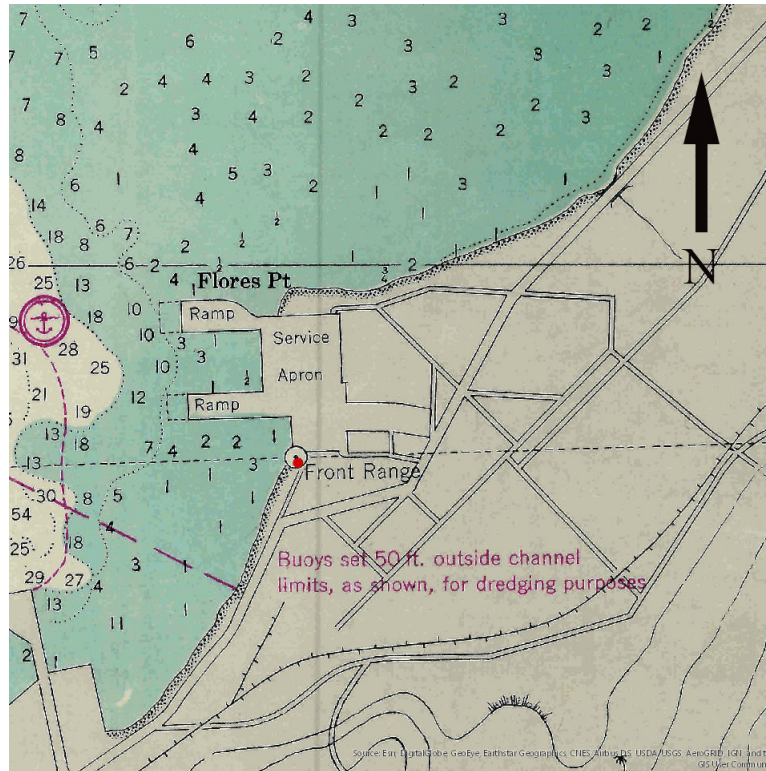


FIGURE 4.12. ArcGIS overlay illustrating GPS point of modern front range tower (red) superimposed on georectified H.O. Field Chart 2015 from 1944. Note the location of the modern range in correlation with the range in 1944 (Image enhanced to emphasize location of range. Chart courtesy of NARA Record Group 37).

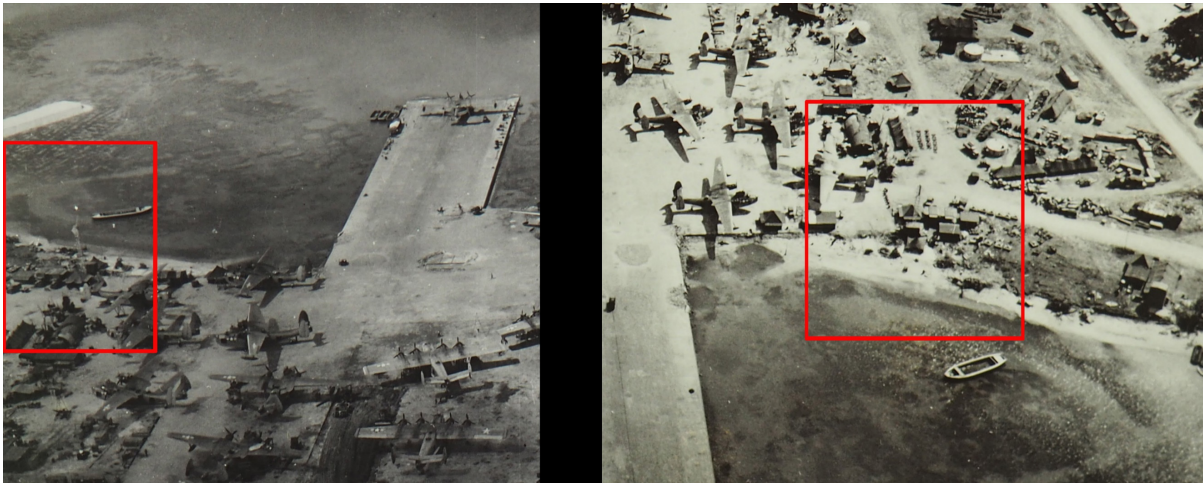


FIGURE 4.13. Aerial photographs of Flores Point Seaplane Base taken on 10 November 1944. Note the front range tower directly adjacent to the seaplane ramp in both photographs (Both images have been enhanced by author to emphasize range tower. Photographs courtesy of CNMI HPO).



FIGURE 4.14. Modern front range tower at Flores Point (Photo taken looking approximately east by author 9 July 2019).



FIGURE 4.15. View of front (right) and rear (left) ranges on Saipan from Mañagaha Island (Photo taken looking approximately east by author 10 July 2019).

4.1.3. Mañagaha Island Survey

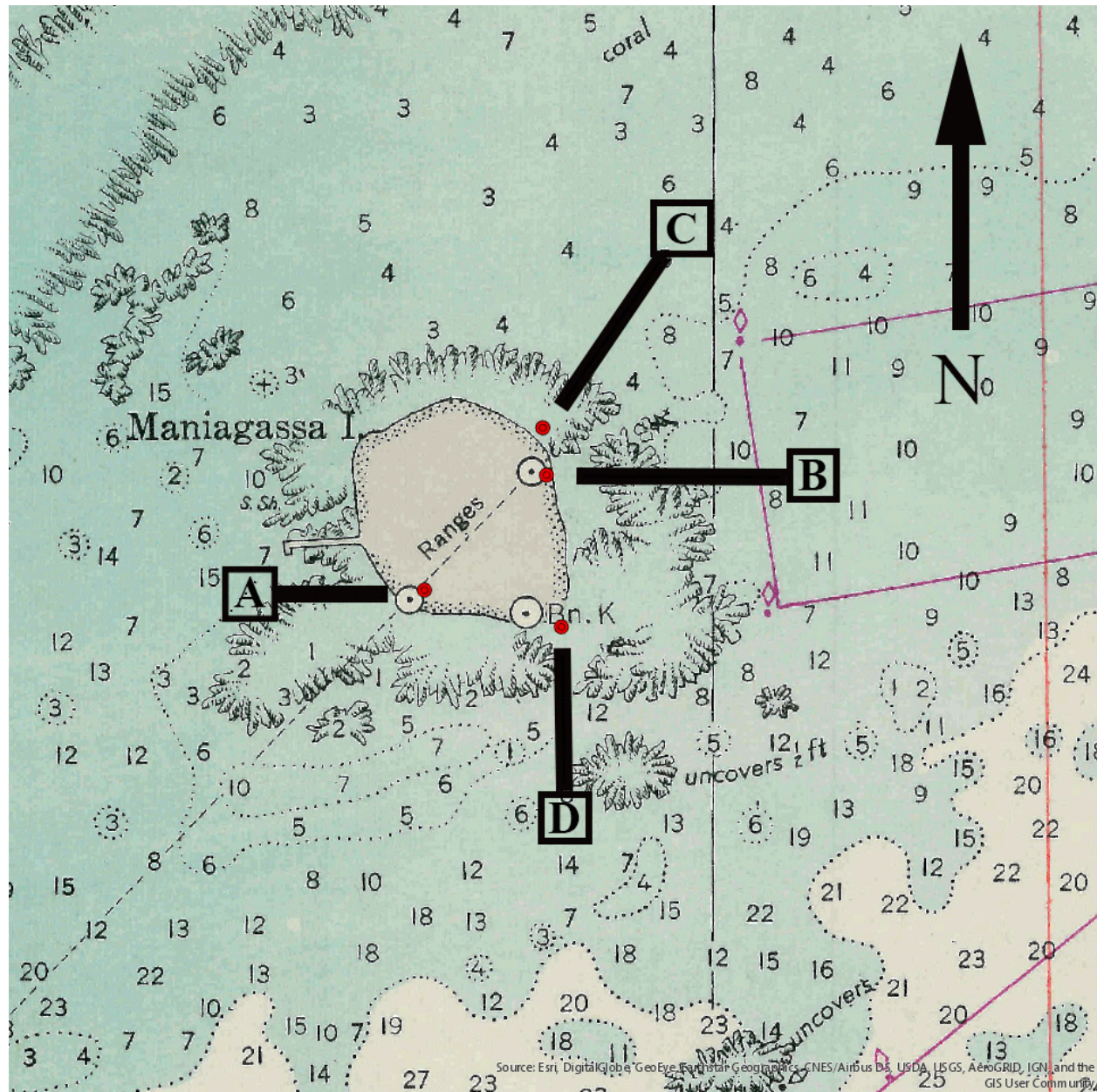


FIGURE 4.16. Sites potentially related to the seadrome (red) overlaid on H.O. Field Chart 2015 (Figure created in ArcGIS. Image has been enhanced by author to emphasize locations. Chart courtesy of NARA Record Group 37).

Shoreline surveys on Mañagaha Island were performed on 10 July 2019. Four sites potentially related to the seadrome were found during these surveys (FIGURE 4.16. Sites potentially related to the seadrome (red) overlaid on H.O. Field Chart 2015 (Figure). This

approximately correlates with the GPS coordinates previously determined through ArcGIS overlay. Although photographs and construction blueprints of the original ranges were unable to be obtained, the weathering of the concrete and level of metal corrosion on the structures appear to date it to the correct time period.



FIGURE 4.17. Front range base on Mañagaha Island. 1-meter scale oriented on approximate north-south axis (north to the right) (Photo taken by author 10 July 2019).

What is believed to be the base of the front range was located at UTM 55P 0361685E 1684209N (refer to point A in FIGURE 4.16. Sites potentially related to the seadrome (red) overlaid on H.O. Field Chart 2015 (Figure). The structure is constructed of concrete in a roughly pyramidal in shape tapering inwards from the square base up with the remains of a large ferrous pipe (likely the remains of the range post) embedded in the top (FIGURE 4.17). The base measures approximately 150 x 132 x 150 x 143 centimeters (cm) with the top measuring

approximately 105 x 105 x 105 x 104 cm. The ferrous pipe is 35 cm wide, has a circumference of 120 cm, extrudes from the concrete 27 cm, and is in the approximate center of the structure being approximately 34 cm from the edge (FIGURE 4.18). The structure displays evidence of repairs distinguishable by different textures and discolorations of concrete in the upper portion (FIGURE 4.19).



FIGURE 4.18. Ferrous pipe in the center of the range base. 1-meter scale oriented on approximate north-south axis (north to the left) (Photo taken by author 10 July 2019).



FIGURE 4.19. Front range on Mañagaha Island. Note the evidence of concrete repairs. 1-meter scale (Photo taken looking to the northeast by author 10 July 2019).

The possible remains of the rear range were observed at UTM 55P 0361826E 1685436N at the approximate location of the rear range as determined through ArcGIS overlay (refer to point B in FIGURE 4.16. Sites potentially related to the seadrome (red) overlaid on H.O. Field Chart 2015 (Figure). Access to this site for detailed recording was not possible as it is located in a natural area set aside for the protection of shearwater birds. As a result, the author was unable to determine the level of preservation of the structure.

Approximately 40 meters (m) to the north of the rear range site the remains of a concrete structure of similar construction to the front range was located on the nearby beach at UTM 55P 0361821E 1685490N (refer to point C in FIGURE 4.16. Sites potentially related to the seadrome (red) overlaid on H.O. Field Chart 2015 (Figure). It was decided to record this site as it could potentially be related to the rear range or other facilities constructed by US forces, chiefly triangulation stations and tide gauges, for the surveying and operation of the Tanapag seadrome. The site consists of three separate pieces of concrete material dispersed linearly across a

northwest-southeast axis over the span of approximately 11 m. Although no ferrous material was observed, it can be deduced from the general shape of the concrete and the location and size of the holes within it that the purpose of these concrete and rock objects was to support a pole or post such as a pylon.

The northern most artifact of the grouping appears to be the most intact. Largely buried in the sand, it is pyramidal in shape with the only measurable side being 72 cm wide at the base and 53 cm wide at the top (FIGURE 4.20). The central artifact is in poor condition. It appears to have been constructed of concrete and rocks or coral. The original shape is indiscernible. A rough hole approximately 20 x 23 x 43 cm deep (FIGURE 4.21). The southernmost artifact of the grouping is approximately rectangular in shape and in fair condition. The top measures 70 x 54 x 68 x 55 cm and protrudes from the sand approximately 28 cm. A square hole 16cm wide runs through the center with one exit being offset to one side and the opposite exit being in the approximate center (FIGURE 4.22).



FIGURE 4.20. Northern most artifact of the grouping. Arrow drawn in the sand to indicate north. 1-meter scale (Photos taken by author on 10 July 2019).



FIGURE 4.21. Center artifact of the grouping. Note the opening in both photos. 1-meter scale (Photos taken by author 10 July 2019).



FIGURE 4.22. Southern-most artifact of the grouping. Note the opening in the center of the right photograph. Arrow drawn in the sand indicates north. 1-meter scale (Photos taken by the author on 10 July 2019).

Beacon K on Mañagaha Island, along with the former Japanese lighthouse, was the primary control point for surveying the seadrome runways and moorings (USS *Bowditch* War Diary: July-August 1944). These appear to be the only two control points that were visible from all parts of the lagoon and thus were crucial for accurate triangulation. ArcGIS overlay and a shoreline survey revealed that extensive shoreline erosion has occurred on that side of Mañagaha Island destroying or damaging several Second World War period sites. Beacon K appears to have been among these. The author was able to locate possible remnants of the range in the form of a ferrous pipe of similar size to the pipe recorded in the top of the front range base also on Mañagaha Island. This is embedded in rock and coral at UTM 55P 0361842E 1685261N, which

is the approximate area in which Beacon K would be located (refer to point D in FIGURE 4.16). Although several meters east of the projected position of Beacon K, it is possible that this is the ferrous base of that beacon. The artifact was located in the highly active surf zone of the island and thus photographs and accurate measurements were unable to be obtained.

4.2. Underwater Surveys

Speaking strictly in terms of wartime sites formed before and during the battle for Saipan, post-battle salvage operations and the establishment of U.S. military facilities in and around Tanapag Lagoon are largely responsible for the archaeological context of the area today. Large portions of the harbor and lagoon were meticulously combed by USN divers for the purpose of clearing navigational hazards and for the construction of new facilities. Records indicate that the majority of located wreck sites were heavily impacted as they were torn apart piecemeal with the use of torches, cranes, and/or explosives (the latter was the preferred method). Wreckage was then scattered on the sea bottom in place, relocated altogether to predetermined disposal areas, disposed of offshore, or a combination thereof (Service Squadron Twelve War Diary: July to September 1944). The same salvage and recovery methods employed by the USN during this initial phase of U.S. base establishment were continued, specifically pertaining to wrecked aircraft.

4.2.1. JATOs

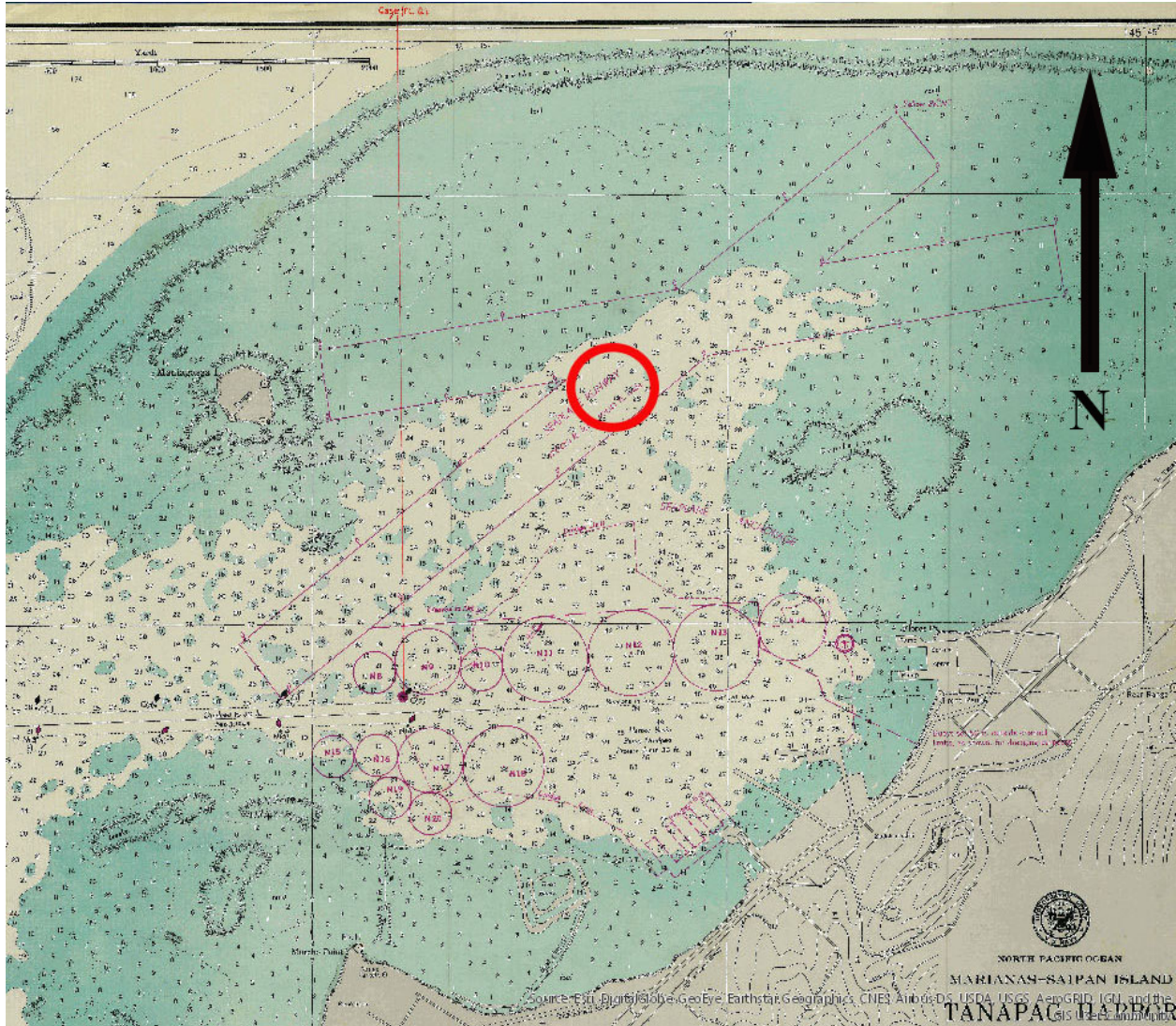


FIGURE 4.23. Central runway grouping of JATO tanks (Figure created in ArcGIS. H.O. Chart 2015A courtesy of NARA Record Group 37).

Two separate groupings of JATO tanks were observed during field surveys. The first grouping was centrally located on seadrome runway 5/23 and contained numerous JATO tanks disbursed across a large area (FIGURE 4.23. Central runway grouping of JATO tanks (Figure). Given the characteristics of JATO tanks, which decreased required takeoff space by as much as 2/3 (Kammen 1959), the location of these tanks is indicative of aircraft beginning their takeoffs at either end of runway 5/23 and jettisoning their JATOs upon becoming airborne near the center of the runway.

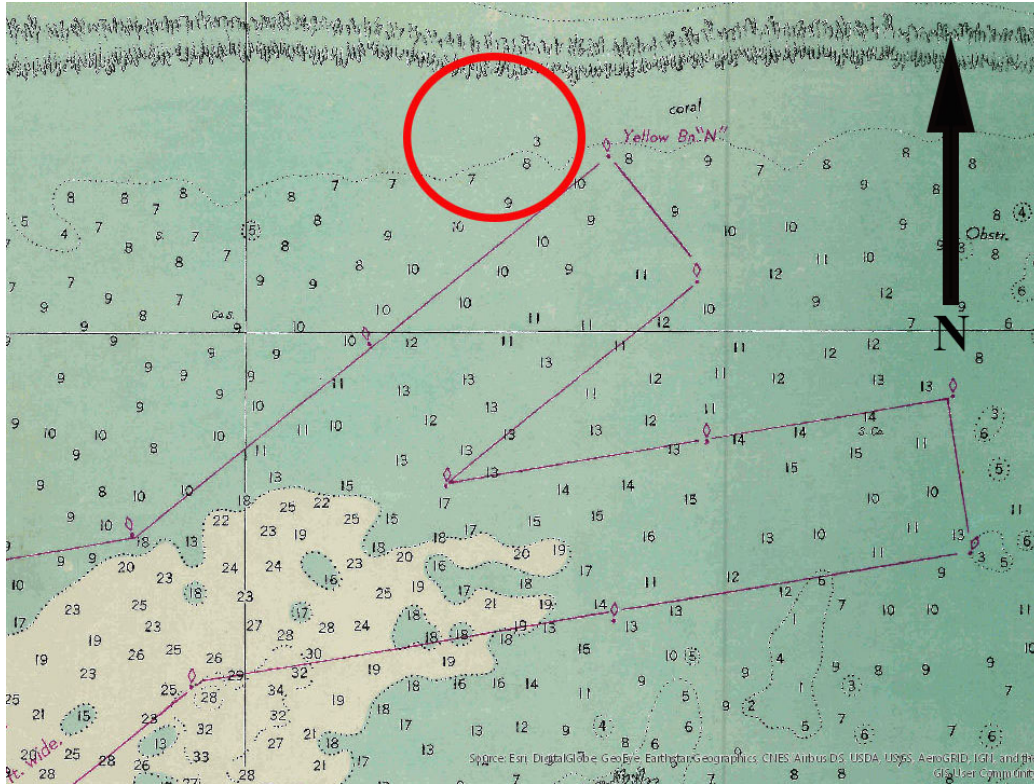


FIGURE 4.24. Northern Runway grouping of JATO tanks. Figure created in ArcGIS on H.O. Chart 2015 (Chart courtesy of NARA, Record Group 37).

The second grouping of JATOs was located during snorkel surveys just beyond the northwestern boundary of runway 5/23 (FIGURE 4.24. Northern Runway grouping of JATO tanks. Figure). Five JATO tanks were located throughout a large survey area amongst the inside edge of the lagoon's protective reef (FIGURE 4.25). The area is an active surf zone with strong currents and surges making the use of a scale bar for photos impossible. While it is possible that the reef acts as a filtering device during times of rough sea conditions, specifically typhoons, the location of this spread of JATOs is conducive of flying boats becoming airborne during takeoff and jettisoning the tanks at the end of the runway while banking away from the island.

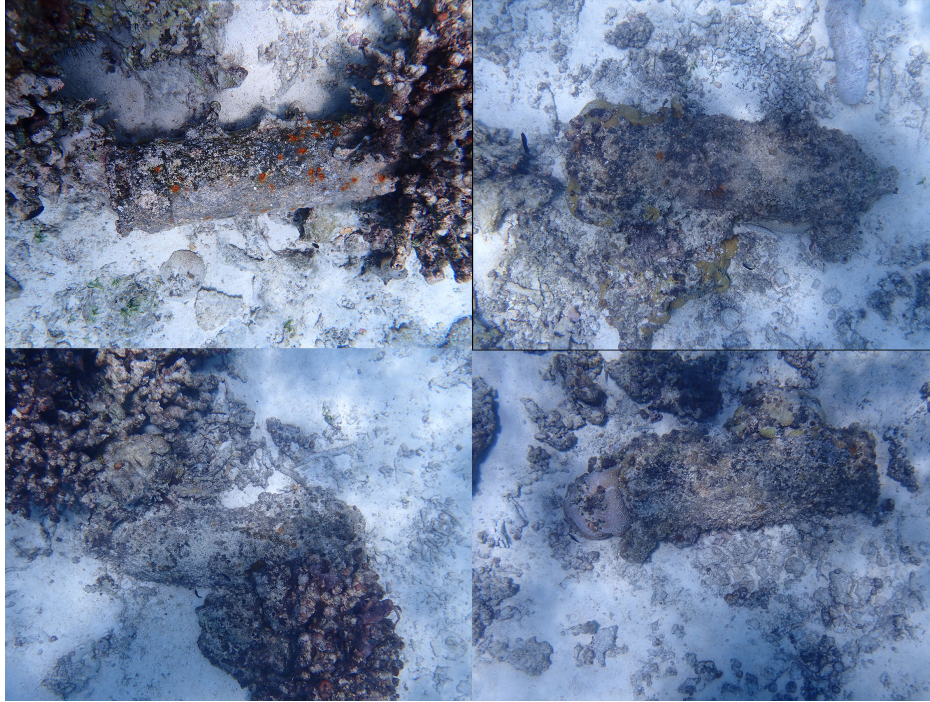


FIGURE 4.25. Four of the five JATO tanks observed during snorkel surveys undertaken on 26 July 2019 (Photo taken by author).

4.2.2. Northern Runway Survey

Near the northern grouping of JATO tanks what is believed to be the remains of the north pylon of runway 5/23, as well as a large Navy stockless anchor, were located during snorkel surveys of the northern runway area (FIGURE 4.26). On the earliest located U.S. charts of the seadrome, pylons appear to already be in place denoting the northwestern and southeastern corners of runway 5/23. No located records discuss the construction of these pylons and so it is theorized that they were originally markers for the Japanese seaplane runway system. If true, the U.S. used this preexisting runway system as a basic blueprint for the Tanapag Seadrome, thus making the pylons among the most important control points during the surveying phase of construction.

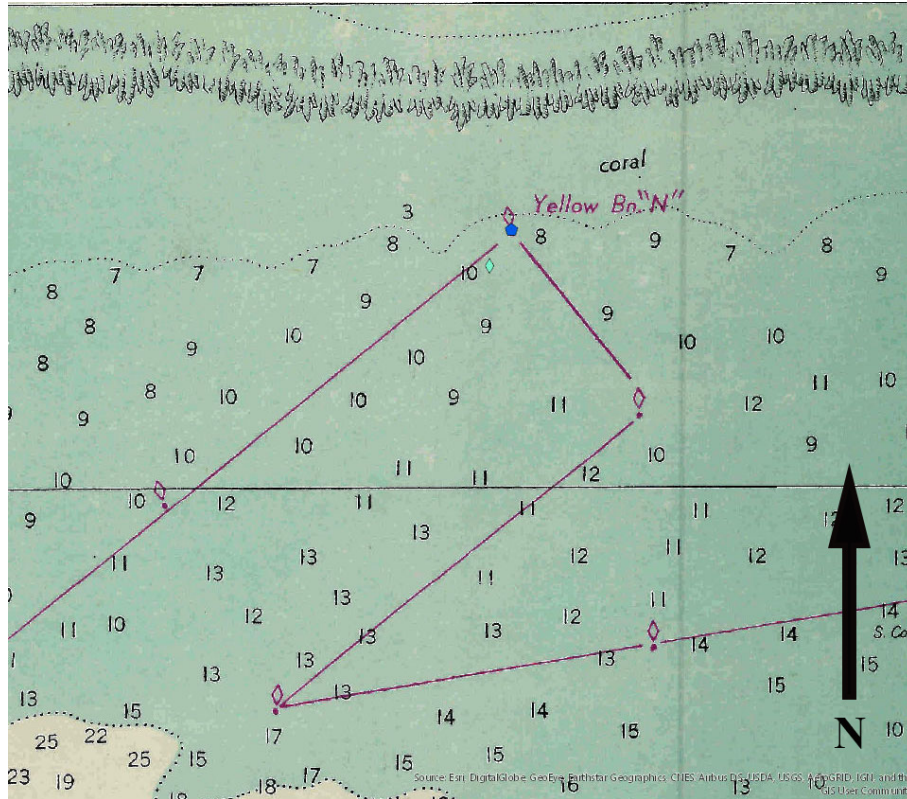


FIGURE 4.26. ArcGIS overlay of GPS points of the possible pylon (blue pentagon) and Navy stockless anchor (teal diamond) overlaid on H.O. Chart No. 2015 (Image enhanced to emphasize area of focus. Chart courtesy of NARA, Record Group 37).

The pylons are documented on early patrol squadron maps of the seadrome (Patrol Squadron Two Hundred Sixteen War History), as well as the H.O. Field Chart No. 2015 published in October 1944. When crews from Service Squadron Twelve outlined the runways in September 1944 with “large yellow permanent buoys” they also planted “two large slatted pyramidal float beacons” at the north and south ends of runway 5/23 (Commander Service Squadron Twelve War Diary, September 1944: 8). With the publication of H.O Field Chart 2015-A in June 1945, the pylons disappear from the charts and are replaced by the floating beacons as the primary navigational marker. It is unclear whether the pylons were destroyed or abandoned in favor using the floating beacons.

What is theorized to be a portion of the remains of the pylon was located in approximately 8 ft (2.5 m) of water during snorkel surveys on 26 July 2019 at UTM 55P 0364551E 1686597N. This is within 15 m of the projected location obtained through ArcGIS overlay. The artifact is believed to be made of concrete with a ferrous object protruding from one side (possibly a pole or post). It is heavily encrusted with coral making a more positive identification difficult. It appears to be resting on one side as opposed to being in its intended position. The top surface is approximately 50 x 38 cm. A measurement of the height from the seabed was not obtained. A ferrous object approximately 10 cm wide protrudes approximately 20 cm (FIGURE 4.27). It is oriented roughly in line with the cardinal directions with the ferrous protrusion being on the southern face.



FIGURE 4.27. Possible north runway 5/23 pylon remains (Photos taken by author 26 July 2019).

The Navy stockless anchor was located at UTM 55P 0364523E 1686547N. The anchor is approximately 1.5 meters in length. Strong surge activity prevented precise measurements and the use of a photographic scale bar. The size of the anchor and the relatively shallow water

depth (approximately 10 feet) make it unlikely that this anchor came from a vessel requiring a standard mooring of this size. Therefore, it is theorized that this may be the mooring for the pyramidal float beacon placed at the north end of runway 5/23. Given the importance of this particular navigational marker and the highly active hydrodynamic environment, it would have required a mooring of substantial size to ensure the permanent position of the beacon. This is conducive of a mooring of this size (FIGURE 4.28). Given the location of the anchor, it is theorized that it has been moved toward shore over time by both natural and human forces.



FIGURE 4.28. Navy stockless anchor found in northern runway survey (Photo taken by author on 26 July 2019).

4.2.3. Buoy Cradles

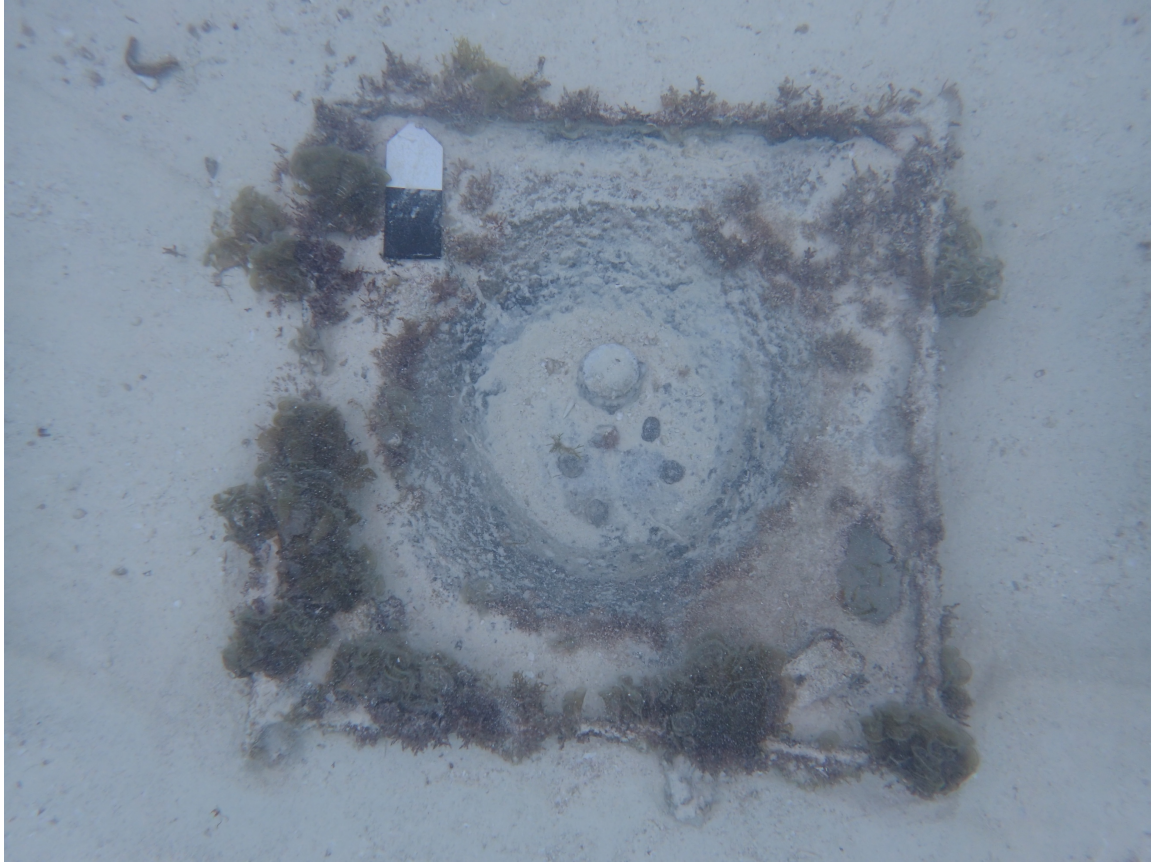


FIGURE 4.29. Possible seadrome buoy mooring (Image courtesy of ECU Program in Maritime Studies 2018).

An examination of data obtained by surveys conducted in the summer of 2018 by a joint East Carolina University/Task Force Dagger Foundation team revealed the remnants of possible seadrome facilities equipment, specifically buoy cradles. It was originally theorized that the objects were sea mine cradles, which are of very similar construction (FIGURE 4.29). It is known that Japanese floating mines were removed by U.S. personnel from the northern east/west seaplane runway (8/26) area during the initial phases of harbor and seadrome development (Commander Service Squadron Twelve War Diary: August 1944). When placed into an ArcGIS overlay, however, the three located objects align with the seadrome runway 8/26 buoy system. Each of the three is approximately centrally located between buoy numbers 14 and 16, 13 and 15, and 15 and 9 (FIGURE 4.30). While records have not yet been located which detail the use

of the such cradles as buoy moorings, their location makes suggests that they were a part of either the U.S. or Japanese seadrome runway system.

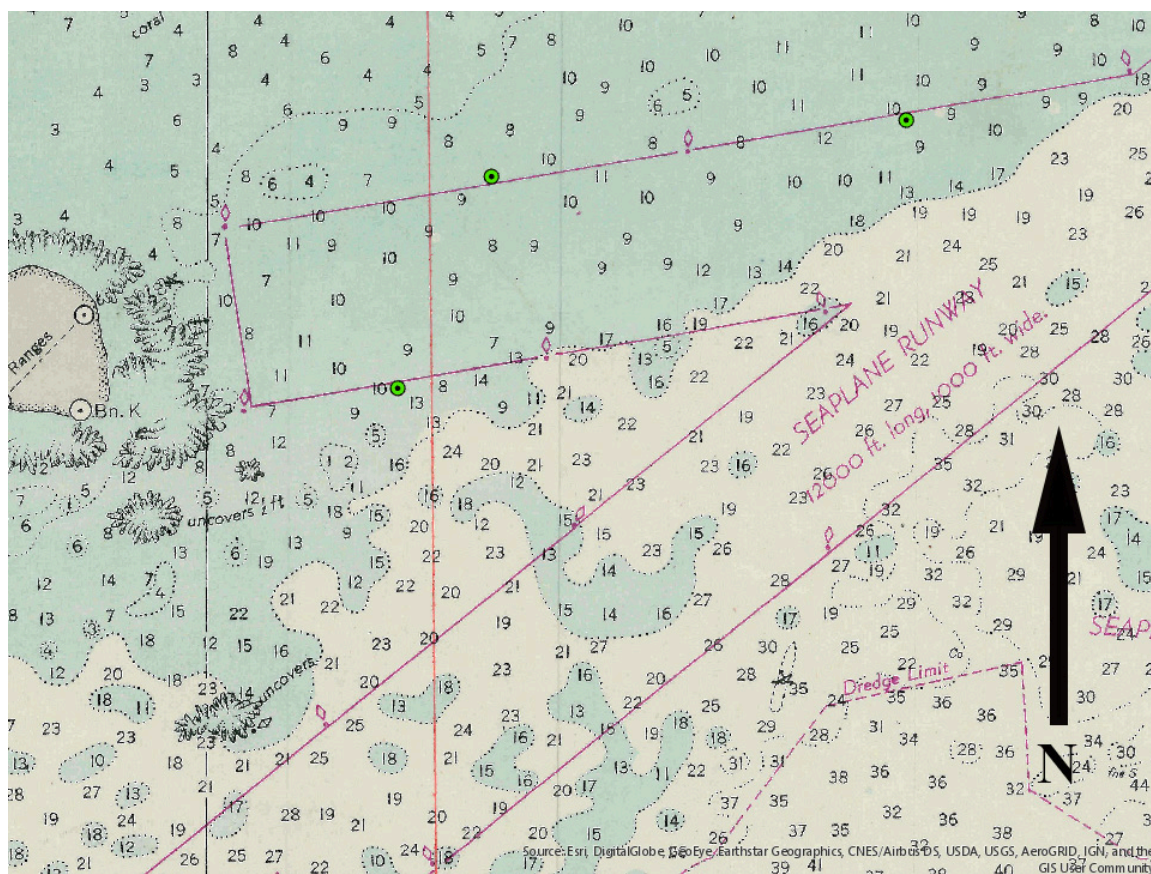


FIGURE 4.30. ArcGIS overlay of GPS locations of possible seadrome buoy moorings. Image created in ArcGIS on H.O. Chart 2015 (Chart courtesy of NARA, Record Group 37).

4.2.4. PBM Mariner Site Surveys Introduction

Site formation processes were the primary theoretical method employed while analyzing the data obtained during the PBM Mariner survey. As Keith Muckelroy first theorized, understanding site formation is crucial to the interpretation of the site itself (Muckelroy 1978). For flying boats, if the wrecking event did not result in a catastrophic structural failure, the airframes often remained afloat for an extended period of time. Efforts by the aircrew and available salvage crews would have been made to save the plane from sinking, but once this fate

was realized as inevitable, component recovery began immediately, at times before the aircraft had sunk. If the aircraft succumbed to its damage and completely submerged, USN salvage crews would dive on the wreck (often on the same day as the wrecking event) and assess the situation. If feasible, an aircraft was often raised either to be repaired and placed back into service, or registered as damaged beyond local repair (DBLR) in which case it would either be placed on a ship bound for a rear area with extensive maintenance facilities or the airframe remained at the base to be used for spare parts.

In the event the aircraft could not be raised, USN salvage crews would recover vital or useful components such as engines, armament, and sensitive documents. Should deceased personnel be aboard, the interior of the airframe would be accessed by whatever means necessary in order to recover the bodies. Following these efforts, aircraft wrecks located within the designated areas of water traffic were rarely left intact. Depending on the location of the wreck, the remaining airframe could either be demolished until the minimum required water depth of the seadrome or harbor was achieved, marked as a navigational hazard, or a combination thereof (Commander Service Squadron Twelve War Diary: July-October 1944).

Records of these operations were maintained (in varying degrees of detail) by the aircraft squadrons, the seaplane tenders involved, Service Squadron Twelve, and CASU F-48. Accounts of the salvage efforts, which detail the general state of the wreck and what components were removed, were then cross-referenced with after-action reports (AARs) of each loss and a process of elimination through location comparison and presence/absence was used to support or eliminate possible identities of the PBM Mariner.

The primary difficulty with this methodology on the PBM Mariner wreck was distinguishing the difference between post-battle and post-war site impacts. As aforementioned,

documented post-battle salvage operations can serve as a diagnostic blueprint for identifying a wreck. Extensive post-war scrap metal salvaging, however, is known to have occurred in and around Tanapag Lagoon (Pruitt 2015). Furthermore, there is evidence of post-depositional “scrambling and extracting” devices (Muckelroy 1978) in the form of site damage and artifact relocation by divers visiting the site (Bell 2010). These factors were taken into consideration during surveys and the later analysis of data.

4.2.5. PBM Mariner Wreck: Two Possible Identities

Through archival research, presence/absence, and site formation studies, the identification of the PBM Mariner wreck has been narrowed down to two possibilities: Bureau Number (BuNo) 45262 or BuNo 45217, both belonging to Patrol Squadron Eighteen. Both of the aircraft were wrecked in the same general area during beginning phases of Tanapag Seadrome operations. On 21 August 1944, BuNo 45262 was attempting an approach to a mooring buoy within the seadrome area when the aircraft ran aground on a coral head puncturing the hull. It was found that the bilge pumps were not operating properly and so the pilot and crew abandoned the aircraft, doing so without closing the watertight doors or notifying the nearby seaplane tenders so that they could render assistance (AAR Card, BuNo45262, Patrol Squadron Eighteen: August 1944). The aircraft then flooded to an undetermined level, but did not fully sink at this stage as it was “bilged on the reef” (USS *Bowditch* War Diary: August 1944, 84).

On 22 August, Diving Barge #2 and Northwestern #2 (N.W.#2), a small salvage vessel of unknown design which was presumably equipped with hoisting apparatus, assisted damage control parties attempting to save the aircraft (USS *Bowditch* War Diary: August 1944, 72). These efforts proved unsuccessful and on 23 August, crews disconnected the engines of the

aircraft (USS *Bowditch* War Diary: August 1944, 76). On 24 August N.W. #2 “lifted salvageable parts of [the] surveyed PBM” (USS *Bowditch* War Diary: August 1944, 80) and on 25 August, N.W. #2 “completed removal of surveyed PBM from coral reef off of seaplane runway” (USS *Bowditch* War Diary: August 1944, 84). According to the after-action report, the aircraft and one of its engines was stricken from the books after being “submerged for 44 hours” (AAR Card, BuNo45262, Patrol Squadron Eighteen). This does not necessarily mean that 45262 was refloated, but rather that the decision was made to strike it after that amount of time being exposed to the water. The striking of only one of the two engines suggests that while the aircraft was on the reef it settled on an uneven keel exposing one of the engines to the sea. There are no records to indicate that the aircraft was brought ashore, put on board a ship, or disposed of in a different location; only that it was removed from the coral reef, which is indicative of submerging the wreckage in deeper water adjacent to that reef.

The second possible identity, BuNo 45217, wrecked on 6 October 1944 while attempting to take off on runway 23. The aircraft had two new engines installed and was going out for a test flight. The weather was poor with heavy swells giving the lagoon a cross-chop. The starboard nacelle bombay was equipped with a 390-gallon external fuel tank, but there was no tank in the port nacelle. When taking off, the aircraft struck a large swell and,

...the starboard wing tip float was pushed up with struts going through the float and torn off. Flap being torn off hit and smashed the starboard stabilizer. [The] plane swerved to starboard, starboard wing tip digging in. [The] pilot cut both engines and the...plane came to a rest on a heading of about 250 degrees, starboard wing half submerged, entire plane being watertight and floating. [The] Starboard wing gradually submerged and when

at an angle of about 80 degrees water started entering the hull through the starboard wing root. Plane capsized and sank in 4 fathoms of water approximately 2 hours and 45 minutes after the accident. Later investigation by divers revealed that only 35 feet of the starboard wing was left, parts of the rest of the wing being the in the vicinity of a protruding coral head... (McKinnon and Carrell, National Register of Historic Places Registration Form: Martin PBM Mariner-CNMI Historic Property Site #7, 8-9) (FIGURE 4.31).

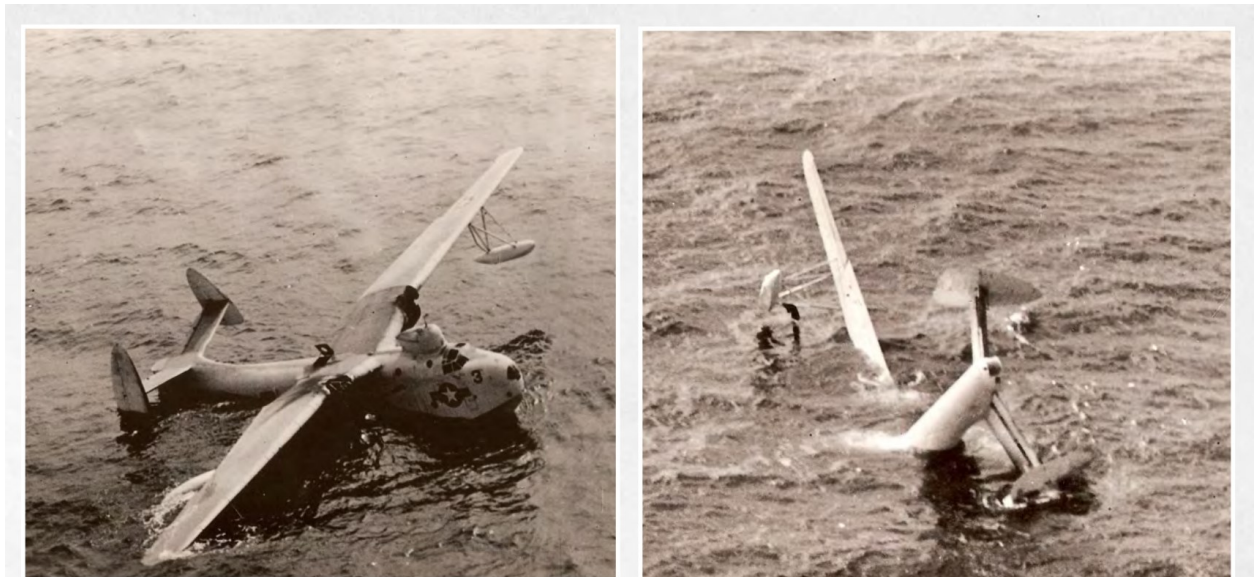


FIGURE 4.31. Photograph of a different Mariner subjected to a similar sinking process. Original caption: "...In 1944 this aircraft was on a test flight when it suffered an engine fire and the pilot was forced to make an emergency landing. It hit the water so hard that both engines were ripped off, but the integrity of the strong hull remained...continued to float for an hour and half before finally succumbing..." (Image and original caption courtesy of weaponsandwarfare.com/2019/01/16/martin-pbm-mariner/).

The aircraft was not saved due "inadequate salvage facilities" (Patrol Squadron Eighteen War History, 21). This is likely due to the inability of AVPs or other salvage-capable vessels to get close enough to the plane as a result of the heavy swells in conjunction with dangerous coral heads. Therefore, "salvage attempts only resulted in the saving of gear that was readily

removable from the plane before it sank” (Patrol Squadron Eighteen War Diary: October 1944, 2). Removed gear possibly included machine guns, intelligence material, and other small items.

4.2.6. PBM Mariner Site Overview

The PBM Mariner site is located at UTM 55P 0362193E 1684876N. The site is situated in approximately 23 ft (7 m) of water and is located southeast of Mañagaha Island and northwest of runway 5/23 (FIGURE 4.32). A large coral head is located in front of what would be the bow of the PBM Mariner wreckage and several smaller coral heads are spread throughout the site area. The wreck is inverted with main fuselage and interior largely disarticulated, but the characteristic gull wing superstructure appears to be largely intact with only a section of starboard wing missing (FIGURE 4.33). There are no engines or propellers present. The auxiliary float struts are still attached to the port wing, but the pontoon float itself is absent. A large Danforth anchor with an attached steel cable that extends to the east is also present.

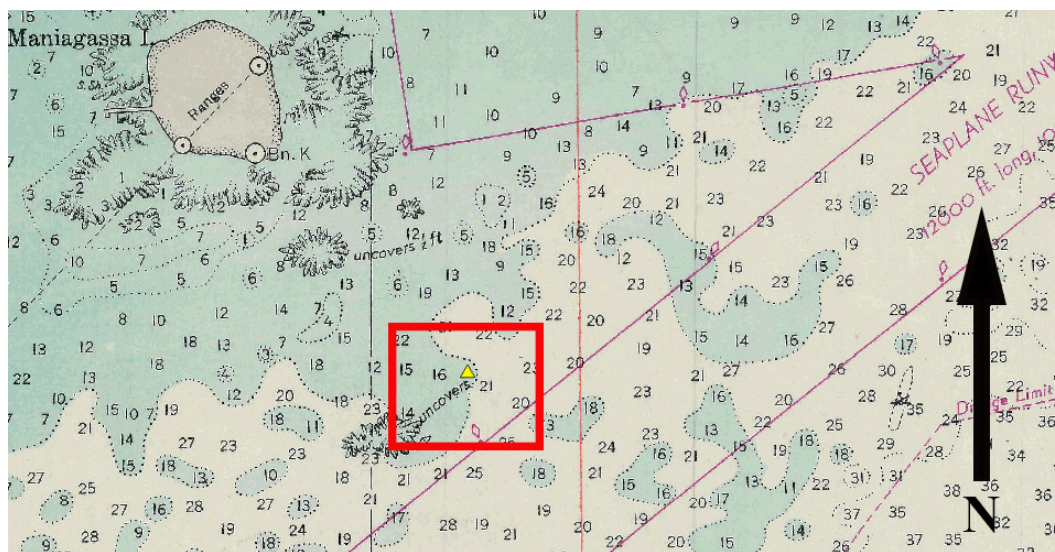


FIGURE 4.32. PBM Mariner wreck site (yellow triangle with red to emphasize general area). Image created by author in ArcGIS with H.O. Chart 2015 (Image enhanced to emphasize wreck location. Chart courtesy of NARA, Record Group 37).

The wreckage distribution does maintain some of the outline of the aircraft with the roof of the cockpit, the dorsal deck turret, and a portion of the tail stabilizer being in their approximate original positions. There are remains of an external fuel tank in the starboard nacelle, but the port nacelle is empty. At least two of the Mariner's three hydraulically powered gun turrets are on site but each are missing the .50 caliber machine guns. Little of the electrical, radio, and radar equipment that was originally on board is still present. A portion of wreckage separate from the main area is located to the northeast on the opposite side of the nearby coral head. Wreckage is also embedded in this coral head primarily on the northeast and east faces. Henceforth, this sub-area of the overall Mariner site will be referred to as the fuselage site.

4.2.7. Fuselage Site Survey

Mariner site surveys occurred on 26 and 28 July 2019 over the course of two dives. Following a preliminary survey in June 2018, the author theorized that the wreckage located in the fuselage site is the remains of the starboard wing from BuNo 45217 as noted by USN divers following the wrecking event of that aircraft (McKinnon and Carrell, National Register of Historic Places Registration Form: Martin PBM Mariner-CNMI Historic Property Site #7, 8-9). This theory was supported by the observed presence of wreckage embedded in the nearby coral (also an observation made by USN divers). As such, the primary goal of the first dive was to record the fuselage site in detail.

Measurements taken of the starboard wing of the Mariner determined that there was approximately 11 ft of wing remaining extending out from the nacelle, with approximately 25 ft of wing still present overall. These measurements were taken using the standard system in order to simplify correlation of data with records. This indicates that approximately 34 feet of wing has

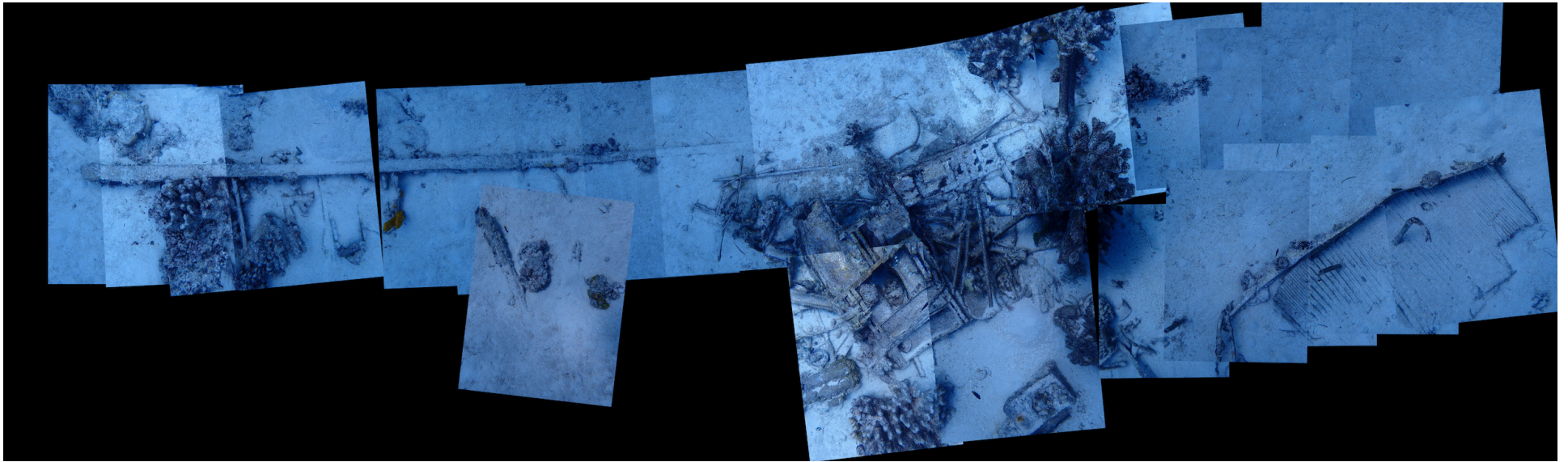


FIGURE 4.34. Photomosaic of the unidentified section of beam cluster and the interior fuselage section (Photographs taken by author on 26 July 2019 and edited in Adobe Photoshop).

become detached from the aircraft and is the approximate length of the main wreckage located in the fuselage site (FIGURE 4.34).

The fuselage site is separated into two distinct areas: the beam cluster and the coral head wreckage. The beam cluster consists of an I-beam (believed to be made of aluminum) with a mass of tangled debris at the southern end. The beam itself is approximately 4 m long, 73 millimeters (mm) high, and is oriented on a 50/230-degree axis. There is evidence that other I-beams were once attached at 90-degree angles to the main beam (FIGURE 4.35). Aluminum skin is still attached to the I-beam in some areas.



FIGURE 4.35. Image of I-beam illustrating location of formerly attached I-beams. Notice the aluminum skin (Photo taken looking approximately south by author 26 July 2019).

The debris mass is a conglomeration of fuselage, pipes, aluminum frames, electrical components, and miscellaneous objects. A small section of interior fuselage (as denoted by the

corrugated sheeting) is also present nearby. When the debris mass is included, the I-beam cluster is approximately 8.60 m in overall length. In conjunction with an analysis of the I-beam, an examination of the components in this mass determined that the I-beam cluster was inconsistent PBM Mariner wing structure. There appears to be a hatch and what is believed to be the winch and davit for the mooring anchor (FIGURE 4.36) in the debris mass. Therefore, the beam cluster may have originated from the bow compartment where the mooring anchor was deployed from the portside hatch (FIGURE 4.37). The debris located in the coral head was unable to be closely examined due to the presence of an abundance of marine life and coral growth. Therefore, the identity of that portion of wreckage is yet to be determined.



FIGURE 4.36. Possible hatch and anchor davit (emphasized) with nearby winch (right) (Photo taken looking approximately south by author on 26 July 2019).

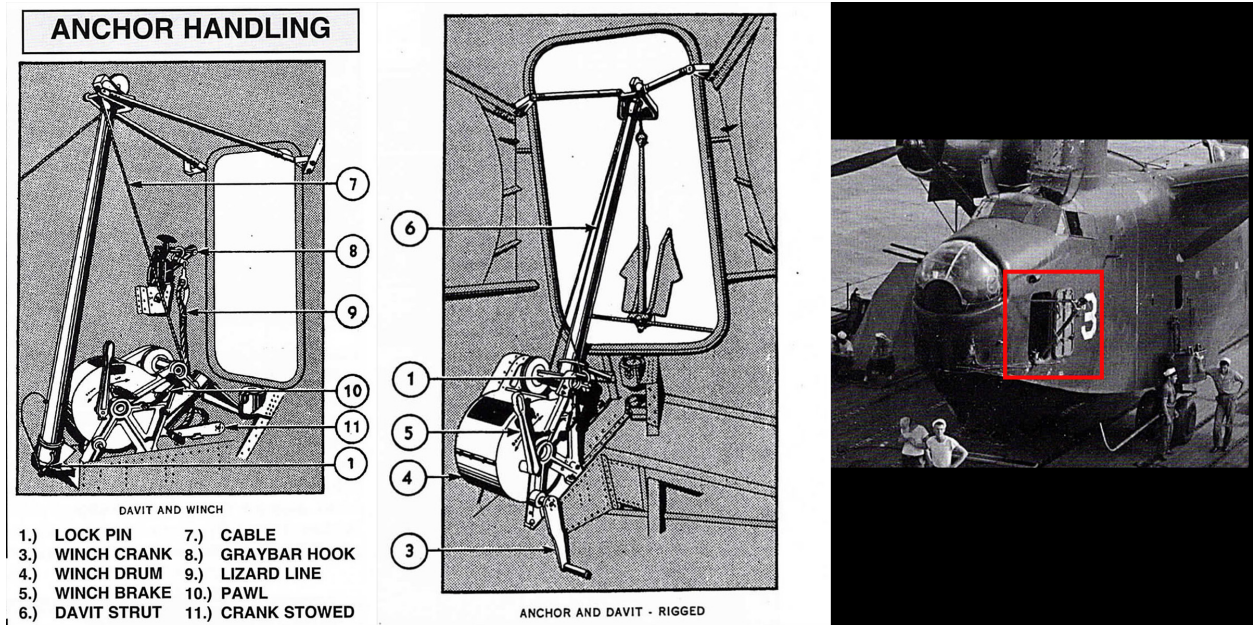


FIGURE 4.37. Illustrations of anchor davit and winch and photo of deployed anchor davit on PBM Mariner (emphasis added) (Images courtesy of Ginter, Steve. *Martin PBM Mariner* pages 83 and 177).

4.2.8. Diagnostic Material Surveys



FIGURE 4.38. Mariner Site JATO tank (Photo taken by the author on 26 July 2019).

Following the conclusion that the beam cluster was inconsistent with wing structure the larger area was thoroughly explored in search of the missing wing structure with negative results. With the failure to locate the missing wing structure, the author decided to concentrate remaining efforts on locating other diagnostic material that could more definitively date the site and/or correlate a specific record of loss. A single JATO tank was located approximately 30 meters southeast of the fuselage site. A close examination showed no evidence that the tank was attached to any fuselage, mounts, or strapping (FIGURE 4.38). Therefore, it is unlikely that this tank was in/on the aircraft at the time of the wrecking event. As numerous JATO tanks were found in other underwater surveys it is surmised that this tank is unassociated.

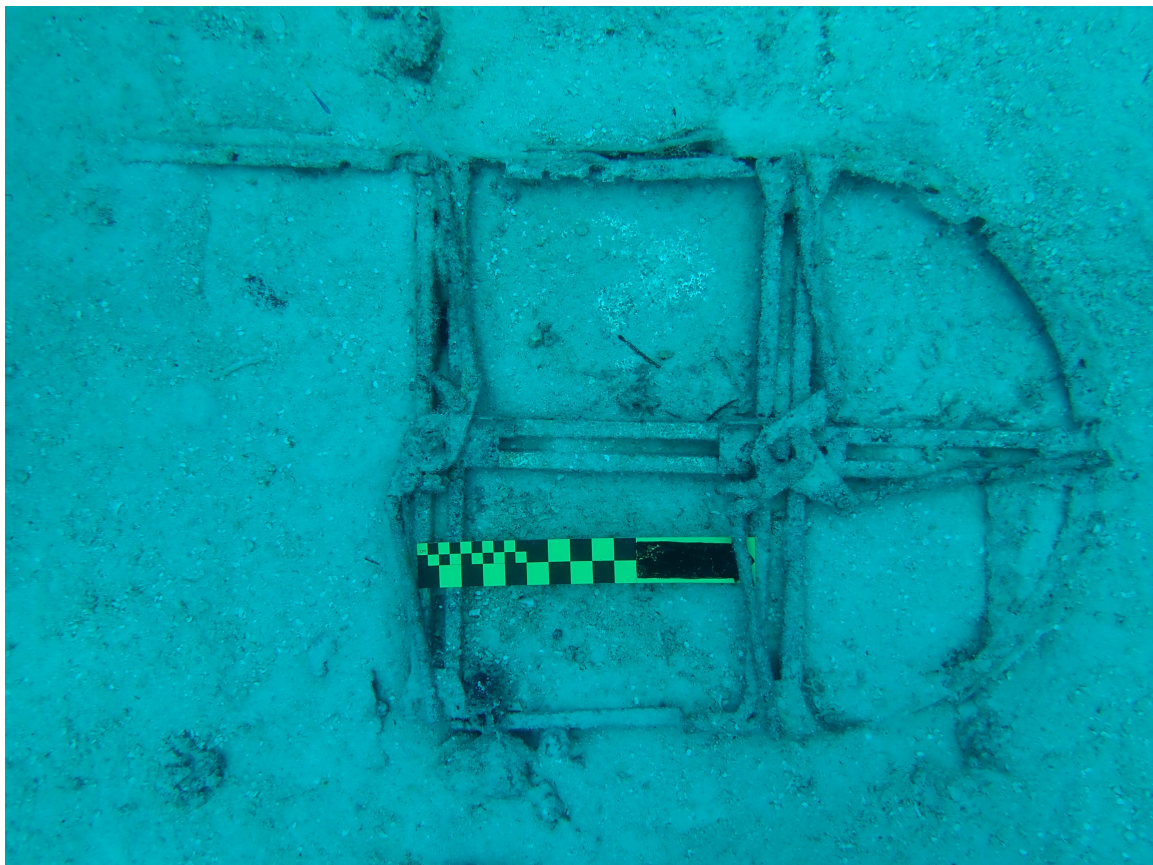


FIGURE 4.39. Unidentified interior hatch (Photo taken by author in 28 July 2019).

An interior hatch was located approximately 25 m west of the gull wing structure. The hatch was neither attached to anything nor located within a reasonable distance of any discernible wreckage of which it may have originally been a part. Unfortunately, neither of the waist hatches were located which could have assisted in dating the site as later model PBMs had JATO mounts on these doors. It was noted that the locking mechanism of the hatch was in the “open” position (FIGURE 4.39).

Approximately 35 m to the southwest of the wing structure, the remains of what is believed to be the stern fin of the hull was located. Previously conducted archival research revealed that all operational PBM Mariners underwent a hull reinforcement, or “bottom change,” instituted by the Glen L. Martin Company in late October 1944 (Carrier Aircraft Service Unit Forty-Eight War History, 8-9). It is theorized that this was a direct result of the leaking issues suffered by Mariner squadrons at Garapan Roads. The change was implemented in the field at aircraft repair facilities throughout the Pacific Theater over a relatively short period of time. Therefore, this is a reliable method to date the Mariner wreck to either before or after this modification. Numerous photographs were taken of the stern fin structure in order to correlate this data. As aforementioned, available time on the Mariner site was severely limited due to circumstances beyond the author’s control, therefore this was the last field survey data that was able to be obtained. Unfortunately, records detailing the bottom change/hull reinforcement were unable to be located thus making this aspect of surveys inapplicable in dating the site.

4.2.9. Analysis of Survey Data and Comparison with the Historical Record

No definitive locations exist for the wrecks of either BuNo 45262 or BuNo 45217. BuNo 45262 was attempting to make a mooring buoy when it was grounded on coral a head adjacent to

a runway. Three runways were being used in Tanapag Lagoon until 25 August 1944 when the southern east-west runway was disbanded as it interfered with ship moorings (Commander Service Squadron Twelve War Diary: 25 August 1944). No records or charts that detail the location of this runway or the early moorings have been located. Given the locations of wreckage and reefs, the runway had to be south of Mañagaha Island likely on a parallel course with the harbor's shipping channel (which ran approximately east-west). As the harbor was highly active with activity at this stage and choked with wrecks, it can be theorized that the moorings were placed between this runway and Mañagaha Island as they would have been well out of the way of boat traffic.



FIGURE 4.40. Large Danforth anchor located in the Mariner site (Photo taken looking approximately north by author 26 July 2019).

Considering the close proximity of the large coral head, it is unlikely that the large anchor on site is the mooring which 45262 was attempting to make at the time of its loss, although it is

the same type, 500lb Danforth, that was the standard aircraft mooring at Tanapag (Base Facilities Summary: Advance Bases Central Pacific Area 1945. 160). This anchor may have been placed as a marker for the wreck and coral head after the fact (FIGURE 4.40). As moorings are located in this general area on H.O. Chart 2015-A and there is a vessel of fair size nearby in aerial photographs from 1945, it is theorized that the anchor may be part of a two-point mooring as well as a hazard buoy mooring (FIGURE 4.41).

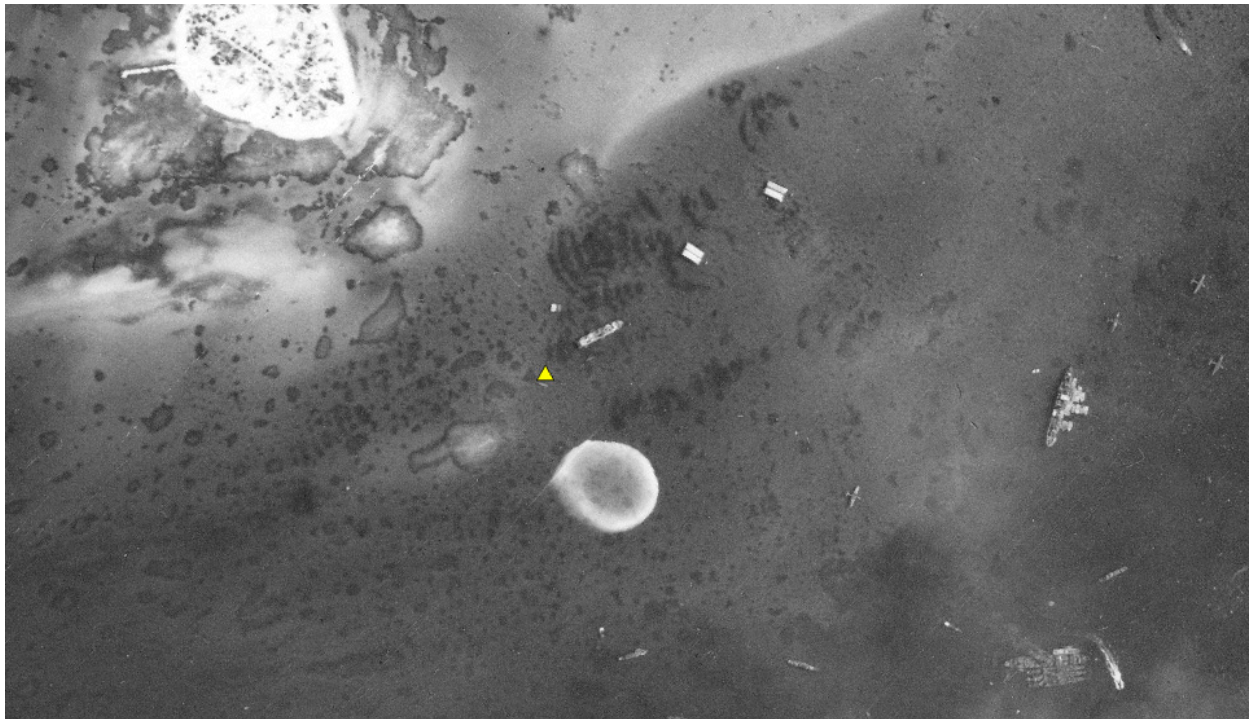


FIGURE 4.41. 1945 aerial photo with GPS point of Mariner wreck (yellow). Notice the large vessel moored just to the northeast (Image created in ArcGIS. Photograph courtesy of CNMI HPO).

BuNo 45217 was taking off on runway 23, meaning that it was on a heading of 230 degrees. When the starboard wing dug into the water pulling the aircraft that direction, the aircraft exited the runway on the side of Mañagaha Island. USS *Shelikof* (AVP-52) recorded the crash of BuNo 45217 as occurring “2,000 yards to the west” (USS *Shelikof* War Diary: October

1944, 2). Although this is only an approximate bearing from the seaplane tender moorings within Tanapag Lagoon, it places the incident in the approximate location of the Mariner wreck site.

Even though the aircraft initially came to rest on a heading of 250 degrees, in the two hours and 45 minutes it remained afloat this undoubtedly would have changed as the submerged starboard wing acted as a pivot point for the aircraft. This heading would have been further affected by the capsizing event itself. It is entirely possible that the aircraft could have changed its heading to match that of the wrecked Mariner during these events.

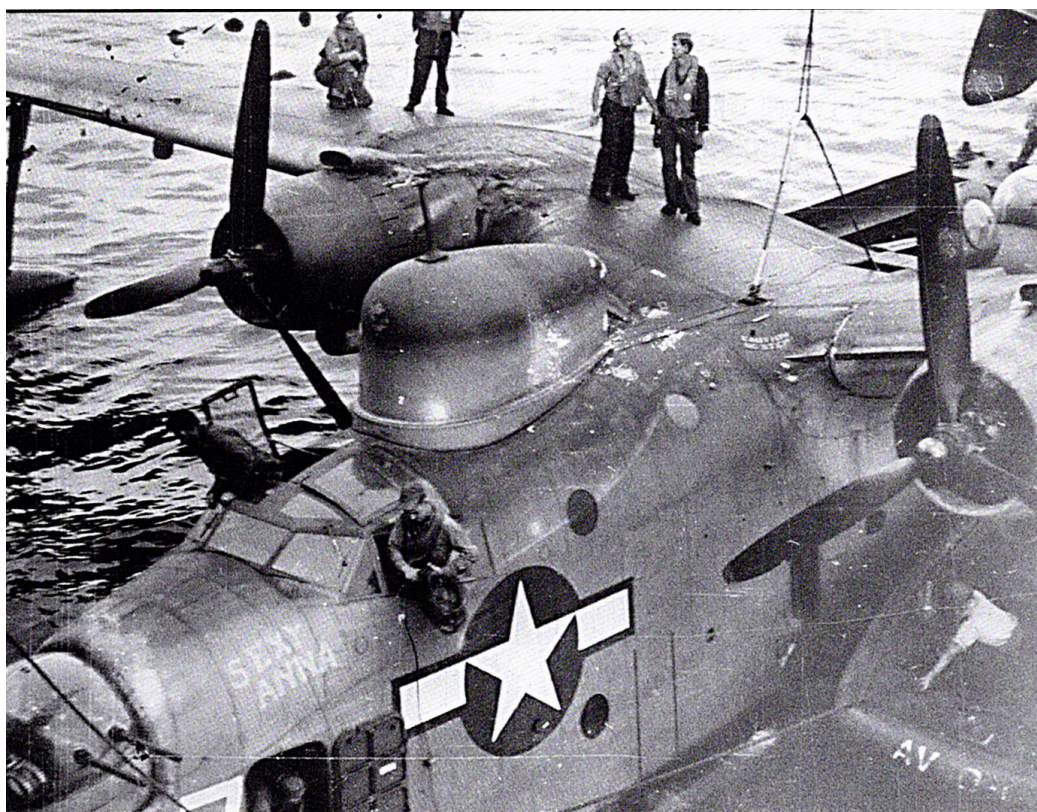


FIGURE 4.42. Photo of PBM Mariner being rigged from hoisting. Note the lifting eyes in the center of the gull wing structure (Image courtesy of Ginter, Steve. "Naval Fighters Number Ninety-Seven: Martin PBM Mariner." page 160).

Although Tanapag Lagoon was a hub of salvage activity at the time of the wrecking events of both BuNo 45262 and BuNo 45217, the only vessels with a hoist capable of lifting the 48,000lb. PBM Mariner either off the reef or out of the water would have been the larger AVs.

These vessels were not used as the proximity to the dangerous coral reefs would have posed too great of a threat to them. Had an AV been capable of reaching the scene, it would have been able to lift the aircraft out of the water even if it were flooded. This was impossible once the aircraft capsized, however as the lifting eye, centrally located on the top of the gull wing, was impossible to reach (FIGURE 4.42). Salvage crews could lift portions of the aircraft, but doing so would have destroyed anything useful, and as the aircraft was not in a high-traffic area, it was not necessary to do so. Simply put, it was not worth the time and effort to retrieve the aircraft.

However, the wreck still posed a potential navigational hazard. Salvage crews were required to obtain a 10 to 15-foot depth clearance everywhere possible within the lagoon (Commander Service Squadron Twelve War Diary: July-August 1944). The Mariner, being some 27 feet tall, was not within those limits. Soon after the wrecking event and the recovery of useful components USN salvage crews could have blown up the aircraft with the use of dynamite in order to obtain the required depth as was standard procedure.

As aforementioned, salvage crews were kept busy in the months following the battle clearing the harbor of human-made obstructions and natural obstacles. Although cutting tools were available, the standard method of demolition for both ships and aircraft was the use of dynamite, which they liberally employed. For example, 35 tons of dynamite was used for salvaging purposes during the month of August 1944 alone (Commander Service Squadron Twelve War Diary: August 1944, 9). Wrecks would be systematically blown into manageable pieces and either lifted and disposed of in deeper water or predetermined areas, or the wreckage would simply be left in place as the required water depth was obtained and no navigational hazard was posed (USS *Bowditch* War Diary: August 1944).

The Mariner wreck site displays evidence of having undergone this type of treatment and would have been subjected to it as the method was timely and efficient. Although much of the fuselage is still present, it is in a disarticulated state having been broken into several large sections. Tellingly, the comparatively fragile roof of the cockpit appears to still be in its proper place. This is indicative of the cockpit roof resting firmly on seafloor and being braced at the time of an explosion thus forcing the blast up and away leaving the roof in its original position but removing the structure to which it was connected (FIGURE 4.43). Had the fuselage around the cockpit been manually cut away, it is unlikely that the roof would have maintained its position so well intact. The starboard nacelle tank may have been blown in this manner as well in order to avoid it becoming a floating hazard if it ever detached from the aircraft (FIGURE 4.44).

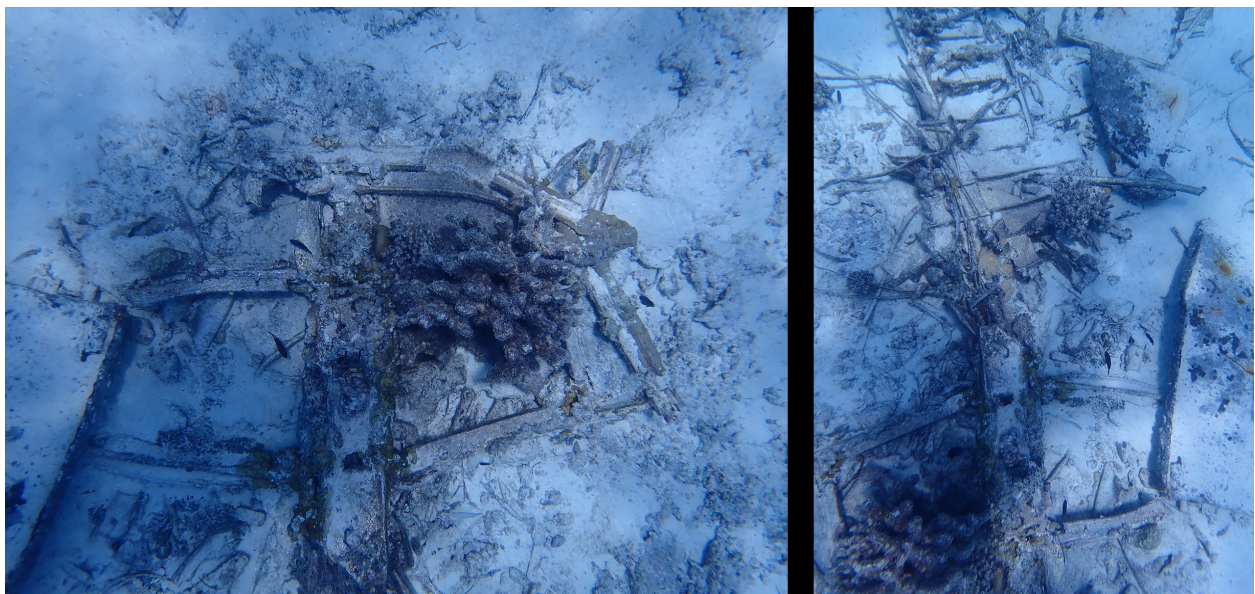


FIGURE 4.43. Overhead view of windows and roof of cockpit (left). Photograph on right is same looking aft (Photographs taken by author 26 July 2019).

As aforementioned, field surveys determined that approximately 25 feet of the starboard wing is still present with approximately 34 feet unaccounted for. Records do not indicate if BuNo 45262 suffered wing damage during the time it was grounded or when it was being salvaged. If the aircraft was resting on an uneven keel whilst bilged on the reef, the wing it was

leaning on could have been damaged or destroyed which would account for the present state of the Mariner wreck. In regard to BuNo 45217, the record states that when USN divers first visited the wreck they noted that only 35 feet of the starboard wing was present. It is possible that this is a typographical error that was meant to say approximately 35 feet was missing. If that is the case, those measurements correlate with the present state of the Mariner and support the identification of the wreck as that of BuNo 45217 (FIGURE 4.45). If the record is accurate, more of the starboard wing has detached since the USN diver inspection. These possibilities downgrade the value of the wing as diagnostic component for individual identity.

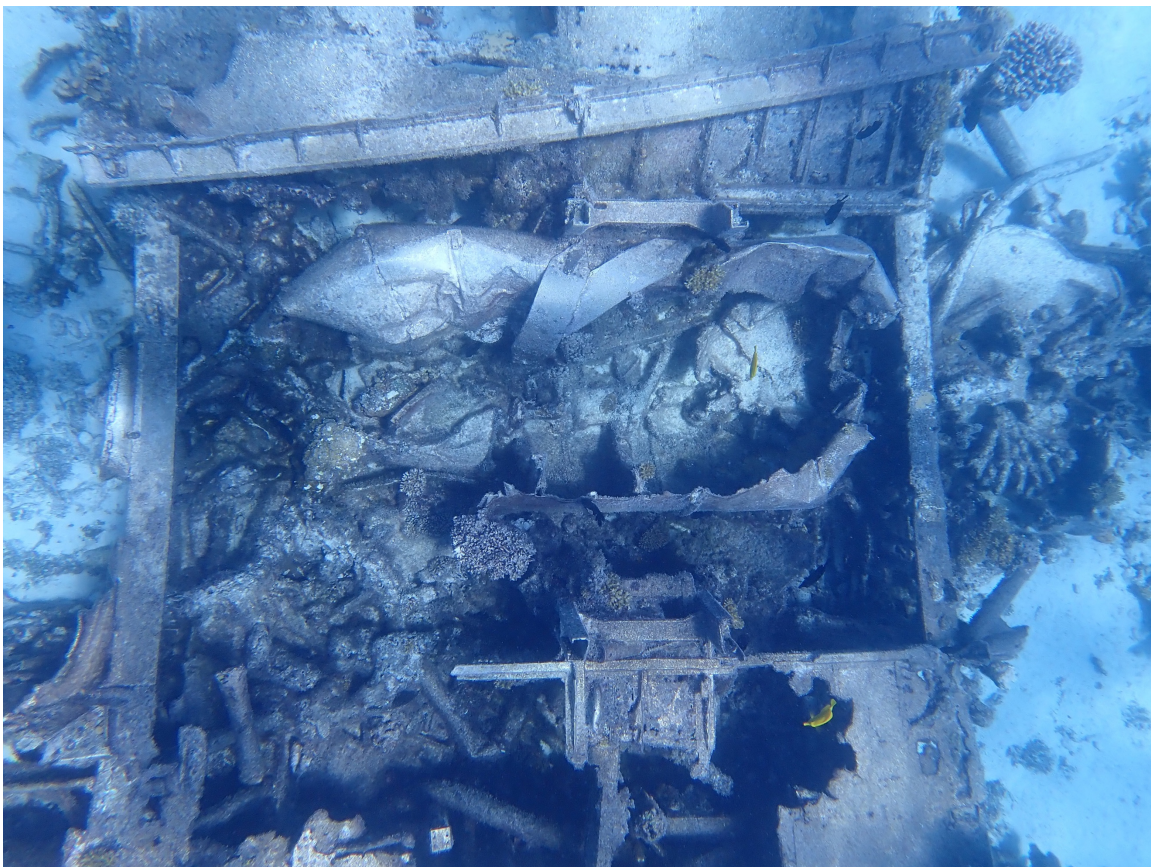


FIGURE 4.44. Image of fuel tank in the starboard nacelle which has possibly been ruptured due to an explosion (Photograph taken by author on 28 July 2019).

The presence of the external nacelle fuel tank in the starboard wing nacelle also does not specifically correlate one identity or the other. While it was recorded that BuNo 45217 was

equipped with external fuel tank in the starboard nacelle, this was a semi-standard procedure. During the first missions to fly out of Garapan Roads, for example, all the PBM Mariners had their external fuel tank in the starboard nacelle filled but without the counterbalance of

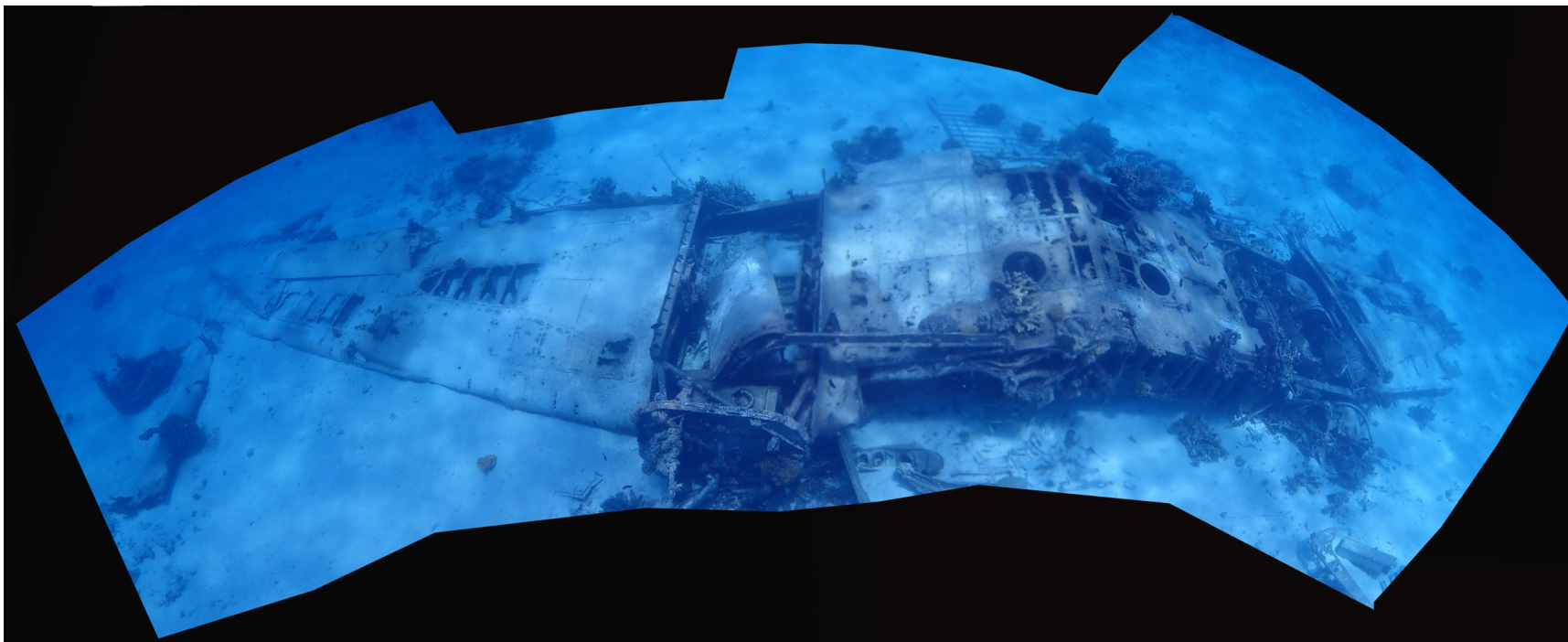


FIGURE 4.45. Panoramic view of the main gull wing section of the PBM Mariner. Image is off-center with the central control point being to the inside of the port nacelle. Note the nearly completely intact port wing and the large missing section of the starboard wing (Photographs taken by the author on 28 July 2019 and edited in Adobe Photoshop).

armaments (Patrol Squadron 16 War History 1945). While this load out was not ideal because it made the aircraft more difficult to handle during take offs as a result of the heavier wing, it appears to have been employed with some degree of regularity. Therefore, BuNo 45262 may have also been equipped with an external nacelle fuel tank in the starboard wing.

The locking mechanism of the galley compartment hatch was in the open position. Standard procedure dictates that all hatches should be sealed shut in order to maintain watertight integrity of the aircraft. While an open hatch is more indicative of BuNo 45262, which had crews in and out of the aircraft for days, it does not necessarily exclusively indicate BuNo 45262 as the identity. Even though BuNo 45217 was watertight at the time of the accident, components of the aircraft were salvaged over the following 2 hours and 45 minutes. Personnel were moving throughout the aircraft in order to accomplish this and it is entirely possible that one or more of these hatches was left open during this process.

The absence of the engines and propellers on the site correlates with the salvaging records of 45262 as it is known that they were removed from that aircraft. However, there was extensive metal salvaging performed throughout in the lagoon in the post-war years to which the engines from the Mariner wreck could have victim. There are also two four-bladed propellers at the nearby “faux site” which may have come from the Mariner wreck site (the PBMs sported both three and four-bladed propellers). It can also be argued that the absence of most electrical components from the site, of which the Mariner had a vast array for radio, radar, and navigation systems, also supports 45262 as the identity as these may not have been left in the aircraft given the extended amount of time in which it was possible to save them. This equipment appears to have still been on board 45217 when it sank and would have been left by USN divers as they were likely inoperable after being wet. These components could also have fallen victim to post-

war metal salvaging as they contained within a large amount of copper. Radio equipment (or really anything with a data plate) is also popular with relic hunters and could have been removed from the site in that manner.

Chapter 5 Conclusion

This thesis aimed to analyze the characteristics and historical significance of forward-area seadromes, specifically the facilities at Saipan, to the Pacific War and the archaeological evidence of them. Standard operating procedures within the Saipan seadromes were analyzed in conjunction with site formation processes was then used to attempt to identify the PBM Mariner wreck located inside Tanapag Lagoon.

5.1. Historical Research Results

First and foremost, an analysis of the historical record has revealed why and how an operational revolution occurred at Saipan in mid-1944. Elements of the Garapan Roads facility can be seen as far back as the WWI with the *Ben-my-Cheree* operation in 1915. The technological developments in seaplane tenders and flying boats that occurred throughout the pre-war years and into the World War Two created the material foundations from which this type of operation was launched. Seaplane operations conducted during the Aleutians campaign and later at Eniwetok Atoll demonstrated to military planners the value that such an enterprise would have for future offensive thrusts into enemy territory.

All of these factors culminated with the need to have eyes in the sky searching for the First Mobile Fleet. Thus, the birth of the Garapan Roads forward-area seadrome facility developed out of expedited necessity rather than by calculated design. Even though the aircraft operating out of Garapan Roads ultimately had little effect on the Battle of the Philippine Sea, the merit of conducting long-range air operations from such a precariously exposed position was recognized and Garapan Roads was not only kept in service but continued to grow. The methods

developed there became the standard procedures of forward-area seadromes which were incorporated into most major military operations throughout the remainder of the war.

Following the decision that Tanapag Lagoon was to become the center for seaplane operations in the Marianas, Tanapag Seadrome and NAB Saipan were established as a means of expanding and streamlining naval air operations there. Furthermore, this permanent facility released the aircraft, tenders, and veteran personnel of the Garapan Roads for availability in future offensive operations. An analysis of the development of the Tanapag Seadrome and NAB Saipan is not only the study of seadrome and harbor installations, but also of wartime salvage operations.

Many of the facilities used for U.S. seaplane and harbor operations were reused or repurposed from the former Japanese system while other aspects were constructed anew. In order to render Tanapag Lagoon free (or relatively so) of navigational hazards, archival data indicates that salvage crews heavily impacted the wrecks and natural formations spread throughout the lagoon. This is largely responsible for the state archaeological record of Tanapag Lagoon today. This thesis, therefore, not only answers questions about the material culture of Tanapag Lagoon, but can be used as a blueprint for similar studies in other locations throughout the Pacific as these salvaging and seadrome construction procedures were somewhat standardized.

5.2. Archeological Survey Results

Field surveys conducted for this thesis revealed that there is substantial physical evidence yet remaining from the Tanapag Seadrome. JATO tanks are unique to flying boat operations in the late-war and immediate post-war period. These artifacts can, with absolute certainty, be correlated solely to Tanapag Seadrome operations. Some seadrome installations, specifically the

harbor ranges, still remain in active use today (albeit upgraded and modernized), while others recorded on Mañagaha Island have fallen into disrepair and are beginning to erode with time. The locations of the theorized pylon, possible buoy cradles, and the navy stockless anchor are indicative of seadrome navigational installations, but this cannot be conclusively confirmed.

The salvage operations undertaken by USN crews largely redefined the archaeological context of the lagoon. The study of their standard operating procedures has posed plausible theories as to how the site formation of the PBM Mariner wreck site and the activities of salvage crews upon it.

Although the identity of the PBM Mariner has not been determined, the number of candidates has been narrowed down to two. As yet there is no evidence to specifically support the PBM Mariner wreck as being one aircraft or the other since none of the diagnostic material located and/or recorded during field surveys does not conclusively support or rule out a particular wrecking event. Therefore, in the absence of either a manufacturers data plate or the confirmed location of another PBM Mariner wreck within Tanapag Lagoon, the exact identity of the aircraft can only be left to speculation.

5.3. Future Archaeological Projects

There is potential for future archaeological projects related to this subject matter. In terms of Garapan Roads, PBM BuNo 48173 (Plane #10 of VP-16) sank at its mooring on 19 June 1944 in 17 fathoms of water (USS *Pocomoke* War Diary: 19 June 1944). Given that this is some two and a half miles from the reef, it is highly likely that the remains of this aircraft exist.

Futhermore, the location of the bowser boat accidentally rammed and sunk by *Ballard* on 18 June

would provide researchers with the approximate area in which the first forward-area seadrome was established (USS *Ballard* War Diary: June 1944).

The archaeological potential for seadrome related sites inside Tanapag Lagoon is much greater. A survey closely following the edges of the runway system could reveal the presence of more buoys and/or buoy moorings. This could confirm or negate the theory behind the aforementioned sea mine/buoy cradle mooring. A broader survey of the northern 5/23 runway area could potentially locate further remains of the runway pylon. Finally, a detailed study of the post-battle USN salvaging operations could not only assist in identifying previously unknown or unidentified wrecks, but could provide further insight into the standard procedures of that type of operation as it would have been a standardized system that could then be used by archaeologists on similar WWII sites across the Pacific.

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